

Service Manual

**CIRCUIT & MECHANISM
DESCRIPTIONS**

PIONEER



The photo shows the model PL-88F.

**ORDER NO.
ARP-143-0**

STEREO TURNTABLE

PL-88F

PL-44F

PL-05

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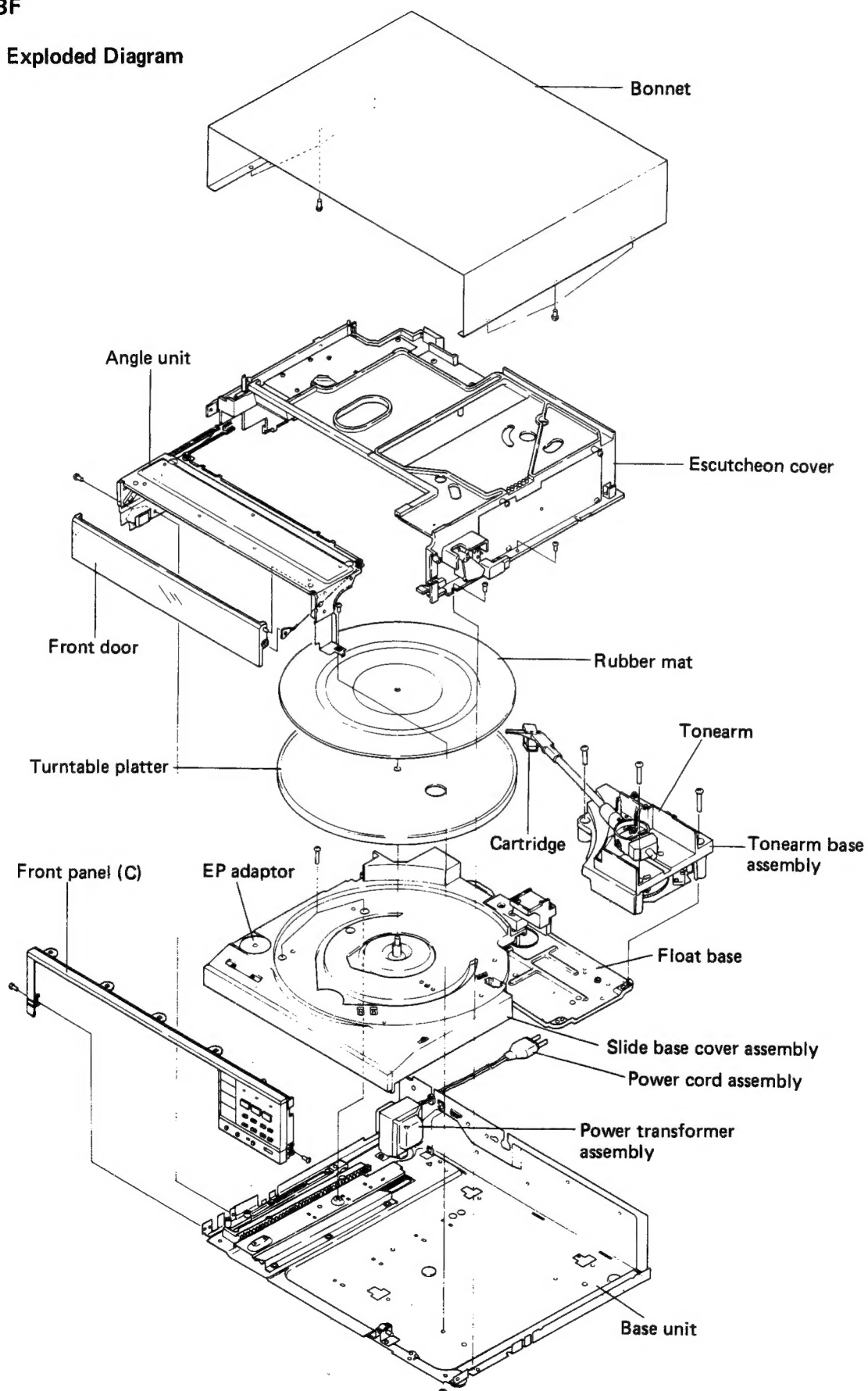
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1. DISASSEMBLY AND ASSEMBLY PROCEDURES

1.1 PL-88F

■ PL-88F Exploded Diagram



1. Press the **O/C** key (OPEN/CLOSE switch), pull the slide base forward, and unplug the power plug from the power socket.
2. Remove the rubber platter mat, turntable platter, and 45 rpm adaptor. Undo screws ❶ and remove the bonnet case by pulling off towards the rear (see Fig. 1-1).

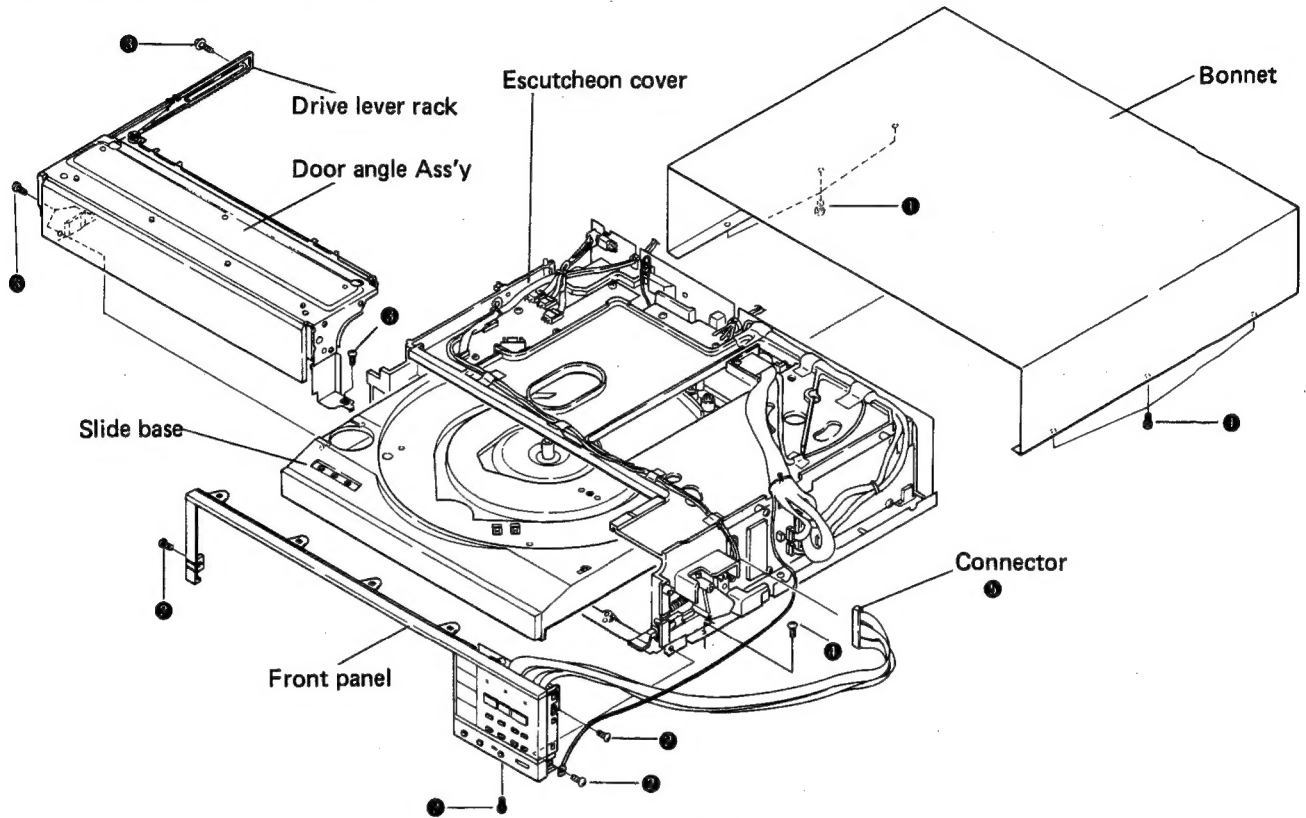


Fig. 1-1 Disassembly 1

3. Undo screws ❷ and remove the front panel (operation panel). This panel can be removed altogether if connector ❺ is disconnected.
4. Undoing screws ❸ enables removal of the door angle ass'y. Since the drive lever rack for opening the door engages the main gear in this door angle unit, perform this operation with due care (see Fig. 1-1).
The wire supporting the left hand side of the door when the door is opened and closed is wound once around each pulley and fixed to point A shown in Fig. 1-2 to ensure adequate tautness in the wire.
5. Undo screws ❶ and carefully lift the escutcheon cover upwards to remove it.
Disconnect all connectors shown in Fig. 1-3 at this time. And since the tonearm is pushed backwards with considerable force, be especially careful when removing the escutcheon cover.

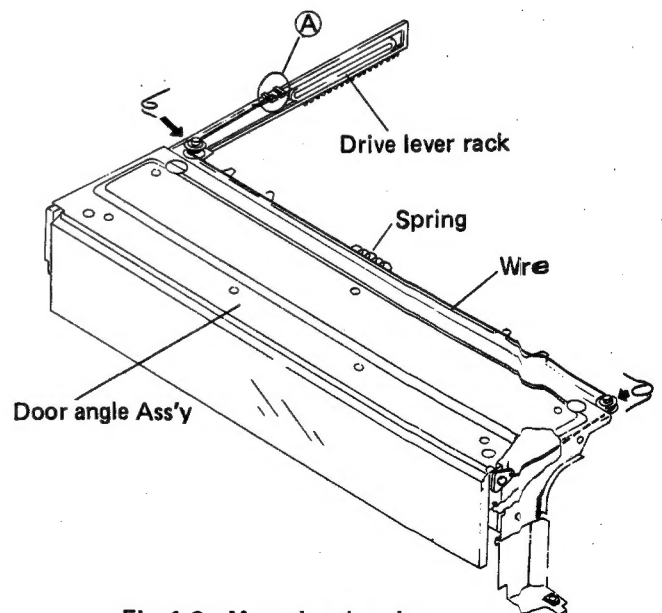


Fig. 1-2 Mounting the wire

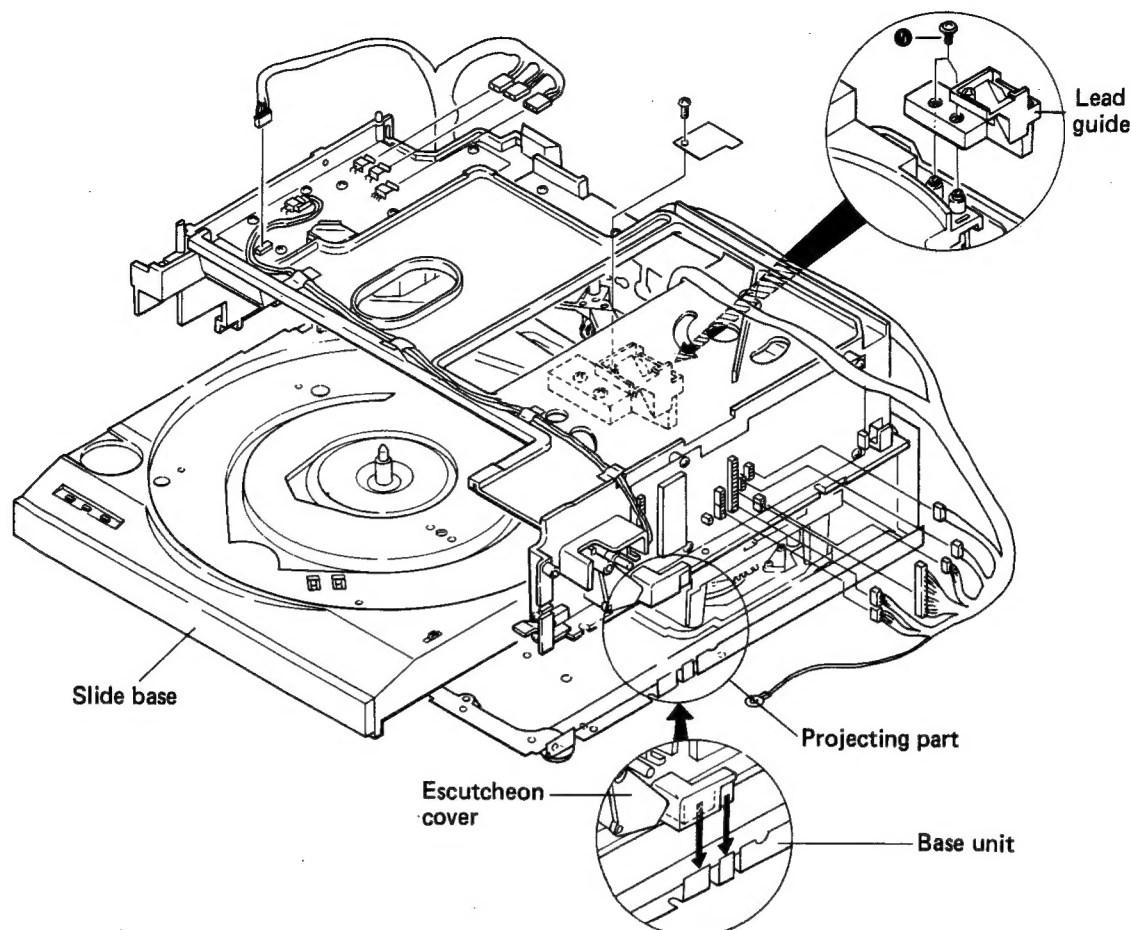


Fig. 1-3 Disassembly 2

■ Mounting the Escutcheon Cover

1. Pull the slide base out sufficiently to prevent the escutcheon cover from pressing against the tonearm head shell when remounting the cover.
2. Replace the escutcheon cover so that the sides slip over the projecting parts of the base, and then secure (Fig. 1-3). Check that the slider pin has entered the lock plate hole at this time (see Fig. 1-4).

■ Mounting the Door Angle Unit

1. Push the slide base back into its normal position, and align the front of the base with the front of the door (see the section on normal inserted slide base position adjustment). After properly engaging gear (F) with the drive lever rack, screw in the relevant screws.
2. After completing the adjustment, check for normal operation, making sure that there is no delay in door movement due to gear backlash.

■ Mounting Gear (F)

1. With the slide base in normal inserted position, check that the front of the base is flush with the front of the door. (If not flush, see the normal inserted slide base position adjustment).

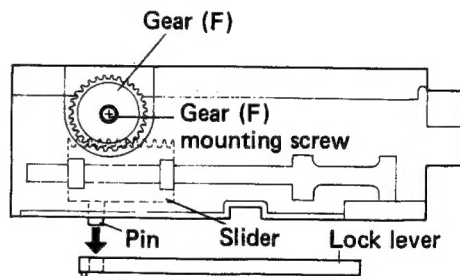


Fig. 1-4 Mounting the escutcheon cover

2. Then while pushing the drive lever rack and slider towards the front panel, insert gear (F) into the escutcheon cover gear (F) mounting boss. Be careful not to push the slider too firmly (towards the front panel) since the slide base cover might also move.
3. Secure gear (F) by screwing in the relevant screws. After tightening the screws, press against the top of the door to check that the door is not loose.

■ Normal Inserted Slide Base Position Adjustment

- A. Electrically, the normal slide base position is determined by the slide base pressing against a position detector switch, resulting in the drive motor being switched off.

- B. Mechanically, however, the slide base is stopped when it strikes a stopper screw at the back of the turntable.
- C. The normal slide base position can thus be changed by adjusting this stopper screw.
- D. This adjustment simply involves turning the adjustment screw from the rear of the turntable as shown in Fig. 1-5. A full turn of the screw changes the slide base position by about 0.5mm.

- 6. Undo screws ⑤ and remove the lead guide. Then without applying too much force, carefully disconnect the leads from the tonearm and phono motor.
- 7. Remove the tonearm section by undoing screws ⑥.

■ Tracking Force Adjustment

1. With the gap between the tonearm and balance weight set to 2.6mm as shown in Fig. 1-6, tighten the weight in that position.
2. Using a tracking force gage, check that the tracking force is $2 \pm 0.3\text{g}$. The tracking force in this turntable is fixed at 2g.

■ Positioning the Yoke(A) Unit

1. When mounting the tonearm, align the center of the screw with the tonearm groove, and tighten the hex screw by applying a torque of 6kg.cm (see Fig. 1-9).

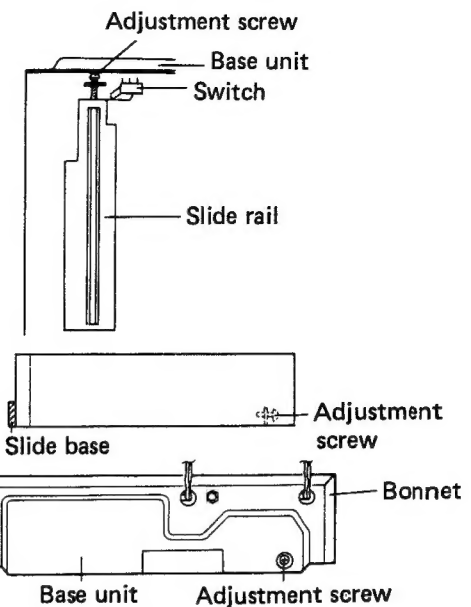


Fig. 1-5 Slide base position adjustment

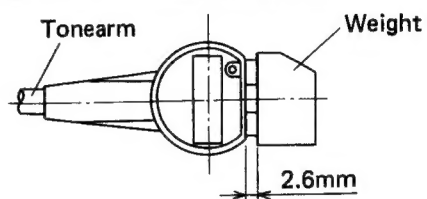


Fig. 1-6 Tracking force adjustment

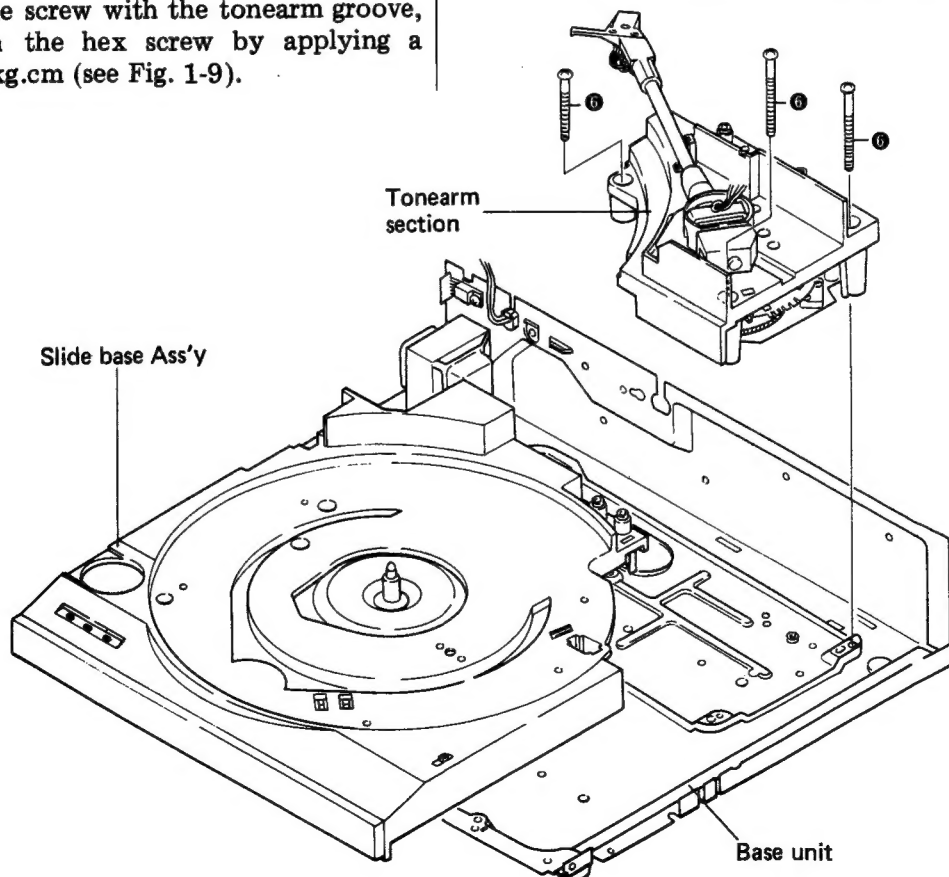


Fig. 1-7 Disassembly 3

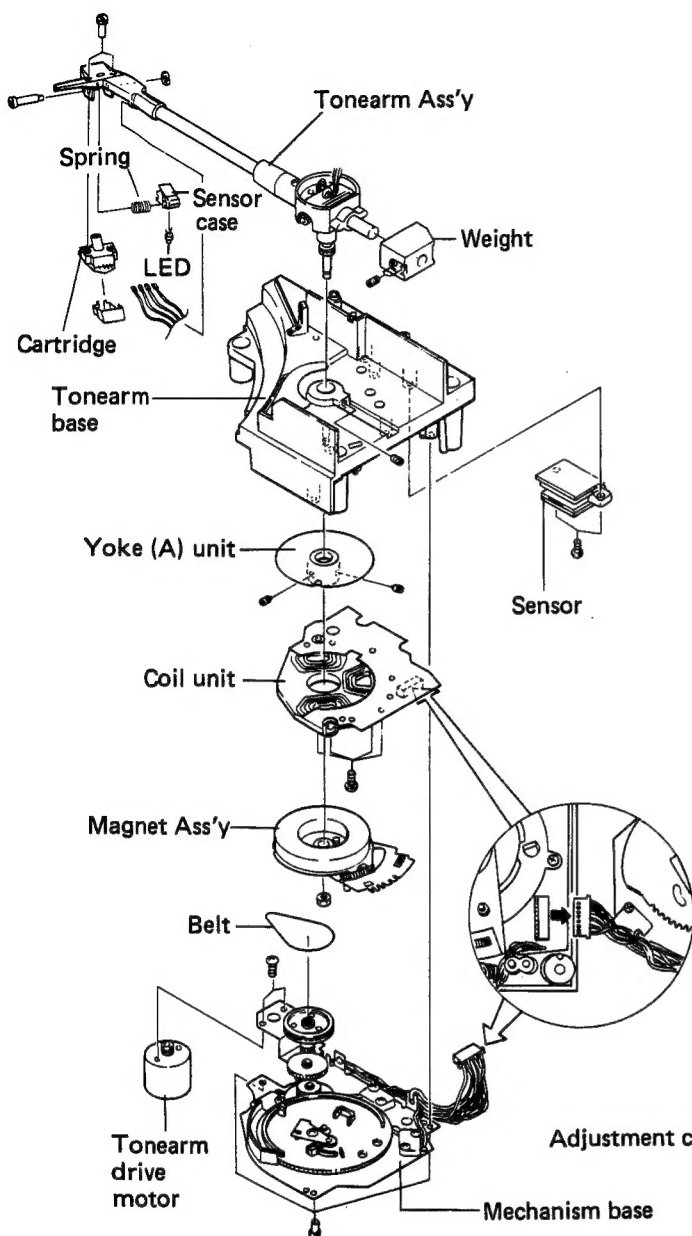


Fig. 1-8 Disassembly 4

2. Insert a 2mm spacer in (A) at this stage. Then with the tonearm in the arm rest, align the center of rib (part A) with the center of the U-shaped notch in the yoke (A) unit, and tighten the two hex screws by applying torque of 12kg.cm (see Fig. 1-9). Remove the spacer after tightening the screws.

■ Mounting the Magnet Ass'y

1. Align the dowel on the rear of the magnet ass'y with the yoke (A) unit groove, and tighten the hex nut by applying a torque of 5kg.cm (see Fig. 1-11). The magnet ass'y is secured by turning the hex nut clockwise.

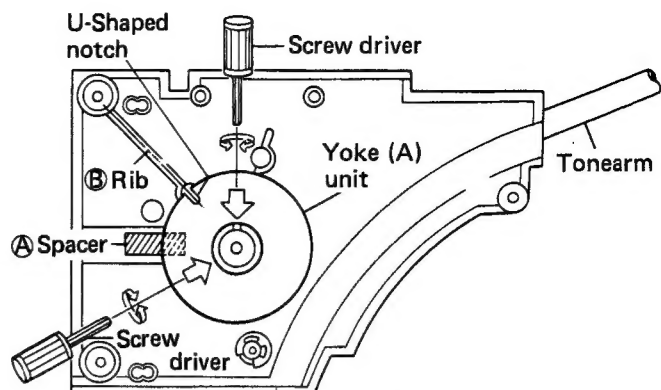


Fig. 1-9 Positioning the Yoke (A) unit 1

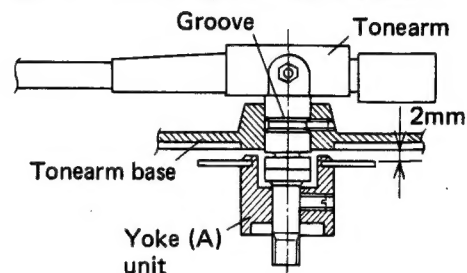


Fig. 1-10 Positioning the yoke (A) unit

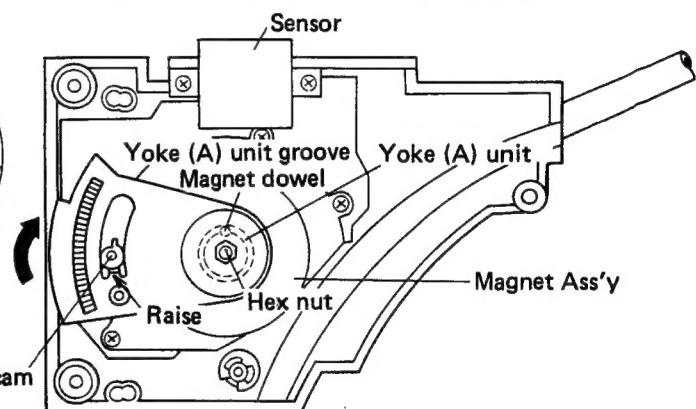


Fig. 1-11 Mounting the magnet ass'y 1

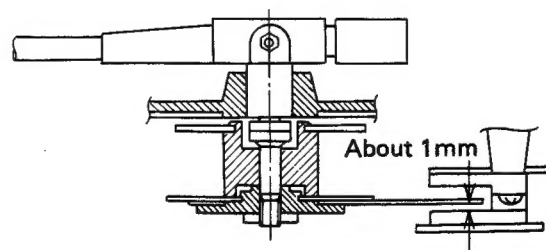


Fig. 1-12 Mounting the magnet Ass'y 2

2. After tightening the screw, rotate the adjustment cam to check that the raised part of the shutter follows the cam when moved.
3. After mounting the magnet ass'y, check that the gap between the sensor and the shutter is about 1mm (see Fig. 1-12).

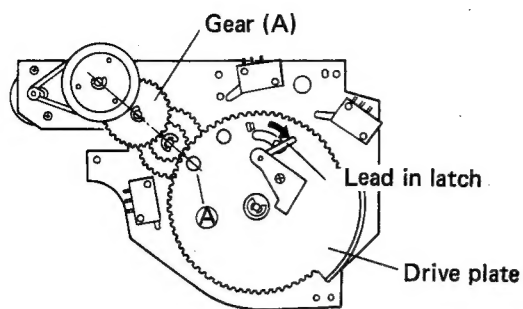
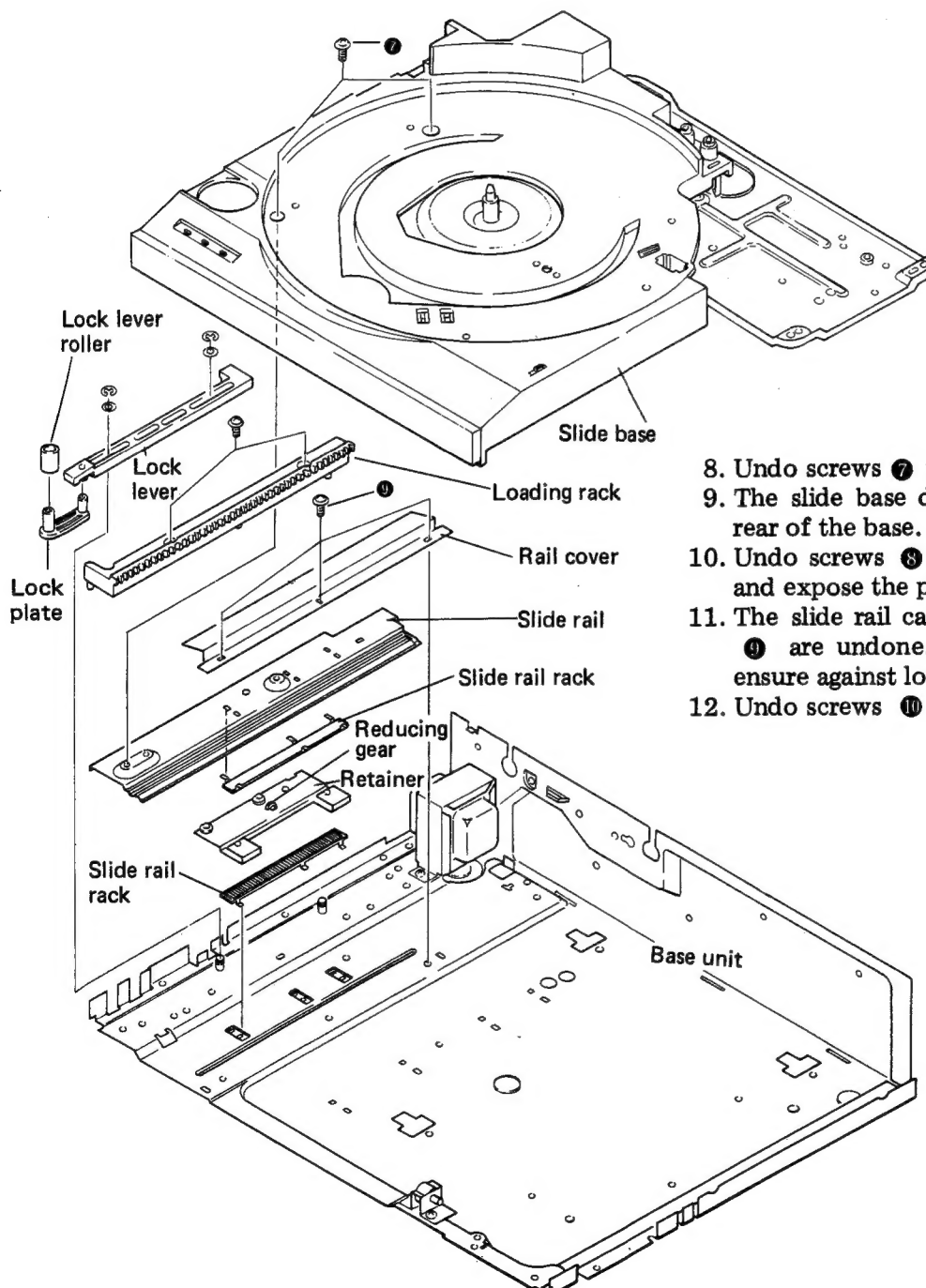


Fig. 1-13 Mounting the mechanism base

■ Mounting the Mechanism Base

1. After turning hole (A) in the drive plate around to the position aligned with gear (A) as shown in Fig. 1-13, open the lead in latch in the direction of the arrow, and mount the mechanism base onto the tonearm base.



8. Undo screws 7 to remove the slide base.
9. The slide base drive motor is attached to the rear of the base.
10. Undo screws 8 to remove the slide base cover and expose the phono motor.
11. The slide rail can be disassembled after screws 9 are undone. Take adequate precaution to ensure against losing any of the bearings.
12. Undo screws 10 to remove the phono motor.

Fig. 1-14 Disassembly 5

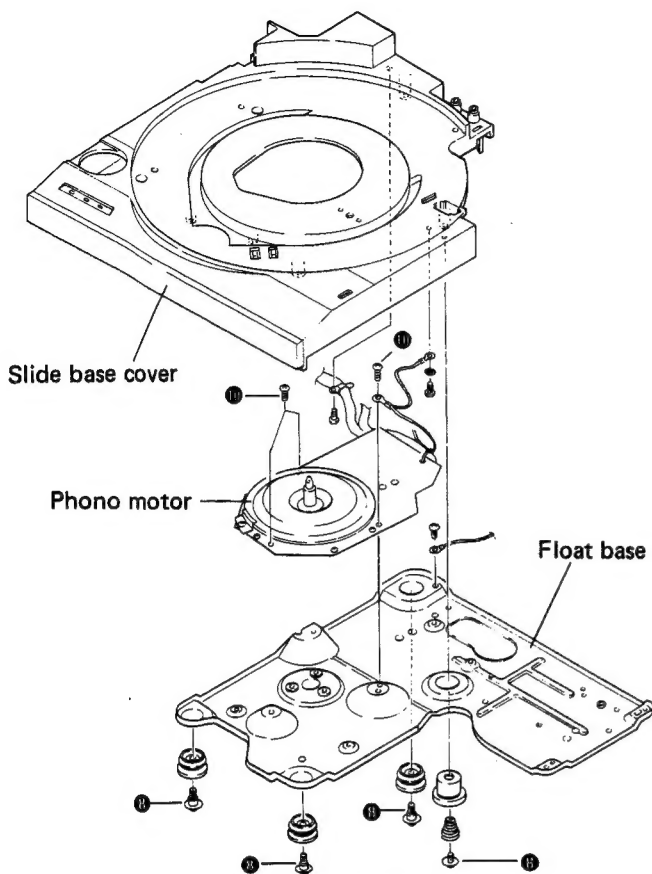


Fig. 1-15 Disassembly 6

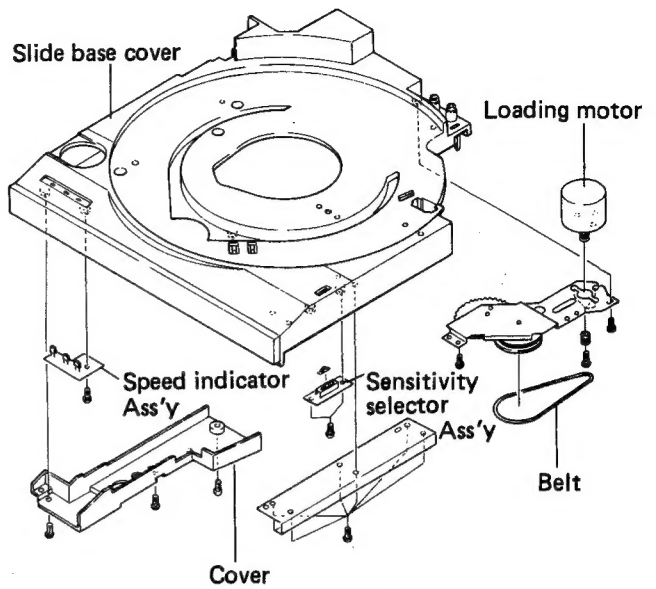


Fig. 1-16 Disassembly 6

■ Mounting the Slide Base

1. Load the lock lever in the loading rack as shown in Fig. 1-17, and pull the slide rail forward from the normal inserted position by at least 5cm.
2. Engage the roller ass'y pin with the roller bearing mounted on the slide base in the way shown in Fig. 1-17.

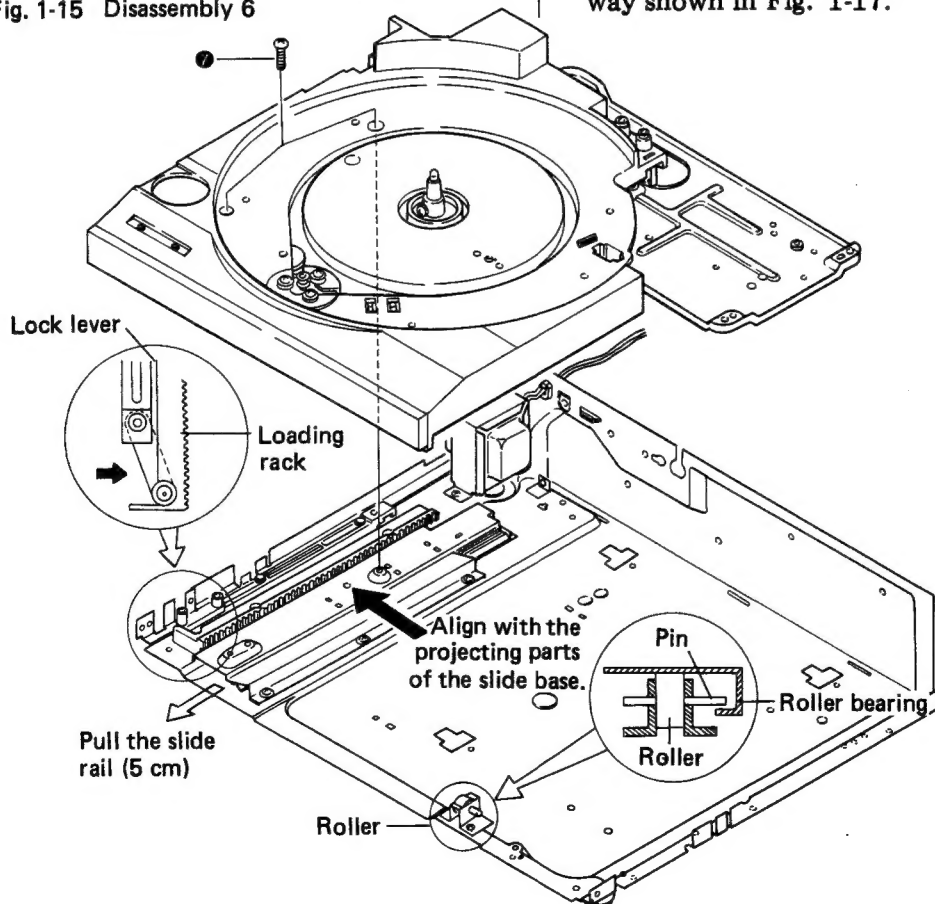


Fig. 1-17 Mounting the slide base

3. Align the slide rail mounting screw holes with the slide base mounting screw holes, and secure the slide base with screws.

When mounting the slide base, make sure that the gear is engaged, and that the lock lever is not dislodged from the loading rack.

4. After mounting the slide base, move it by hand to check that it moves correctly.
- If the slide base is mounted with the slide rail positioned less than 5cm forward, the lock plate will be caught, limiting slide base movement to about only 3 or 4cm.
- Also check against roller ass'y pin displacement.

■ Slide Rail Assembly

1. A cross-sectional view of the slide rail is shown in Fig. 1-18. Assembly involves the insertion of steel bearings (one 6mm and four 4mm) into the retainer, and the incorporation of a reducing gear (half speed).
2. Before inserting the reducing gear, apply a highly viscous grease (GB-TS-1) to the mounting section of the retainer.
3. With the slide base in normal position, align the holes in the slide rail, retainer and base, and secure the rail cover by screwing in screws
4. Then check that the slide rail moves out freely by at least 170mm.

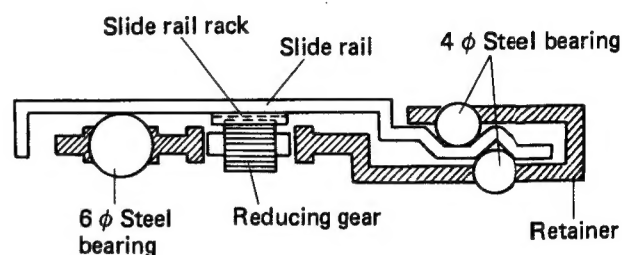
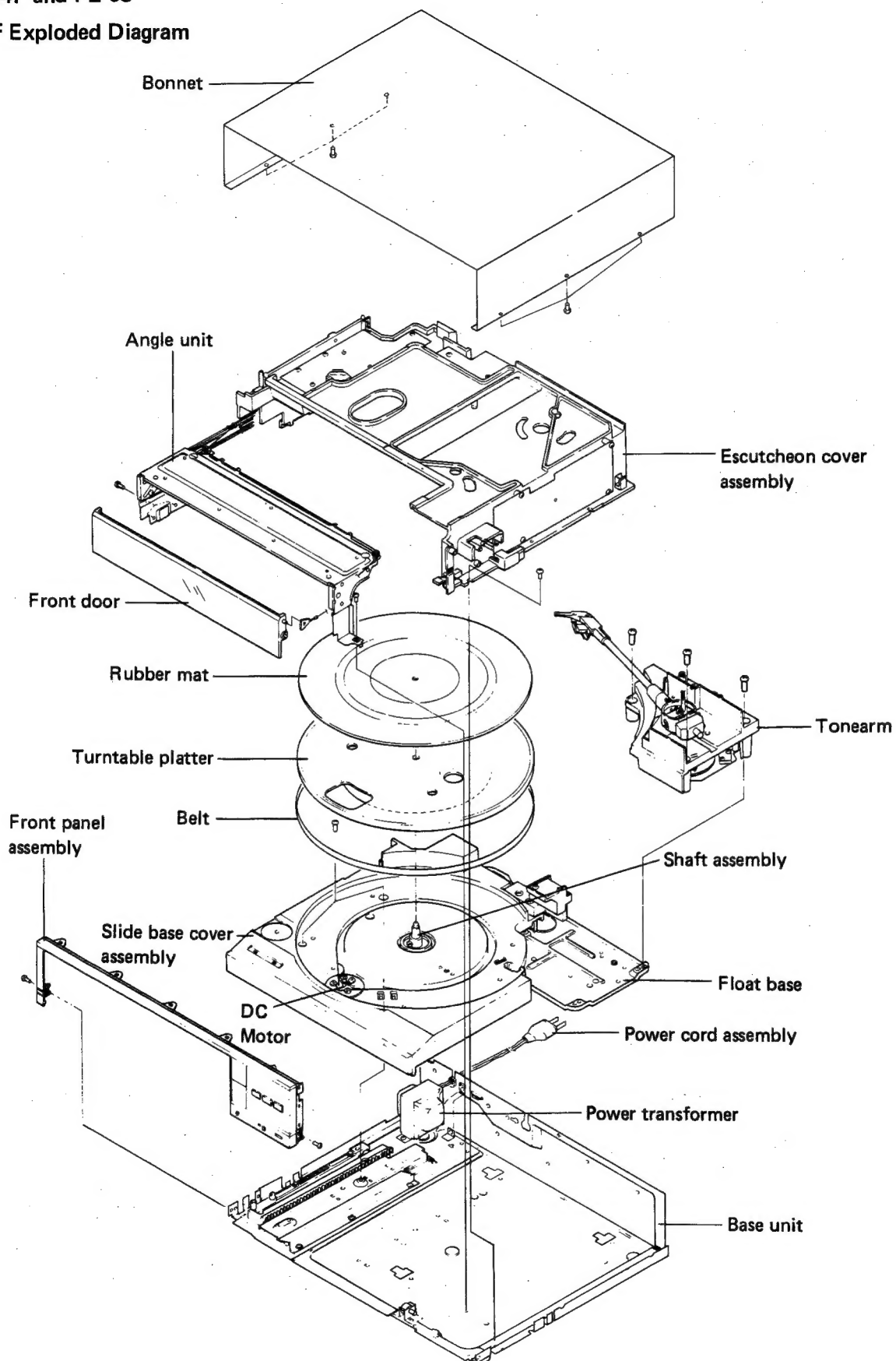


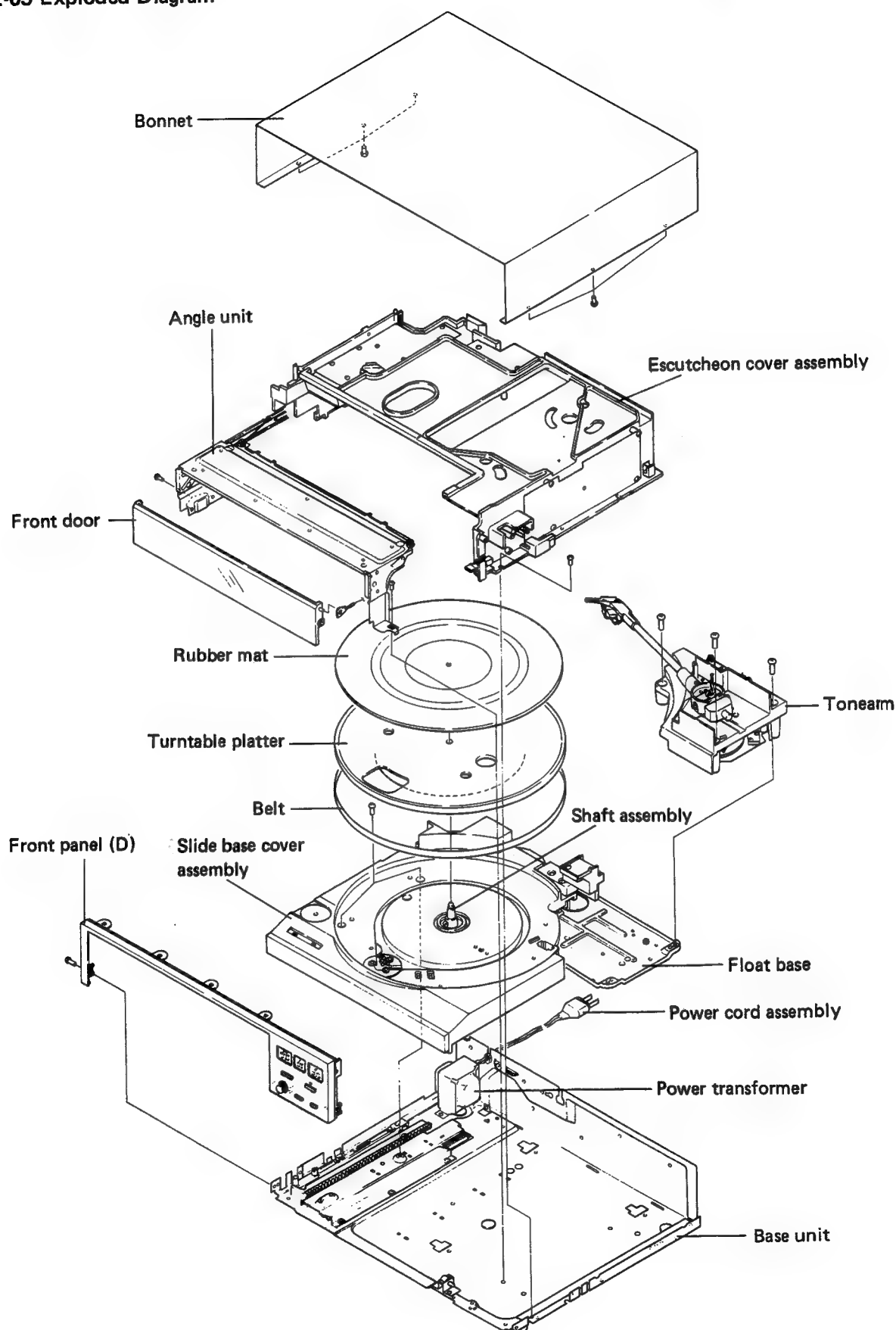
Fig. 1-18 Slide rail assembly

1.2 PL-44F and PL-05

■ PL-44F Exploded Diagram



■ PL-05 Exploded Diagram



* Since the PL-05 mechanism is very similar to the PL-44F mechanism, only the PL-44F mechanism is described here.

1. Press the **[O/C]** key (OPEN/CLOSE switch), pull the slide base forward, and unplug the power plug from the power socket.
2. Remove the rubber platter mat and turntable platter. Then undo screws ❶ and remove the bonnet case by pulling off towards the rear.

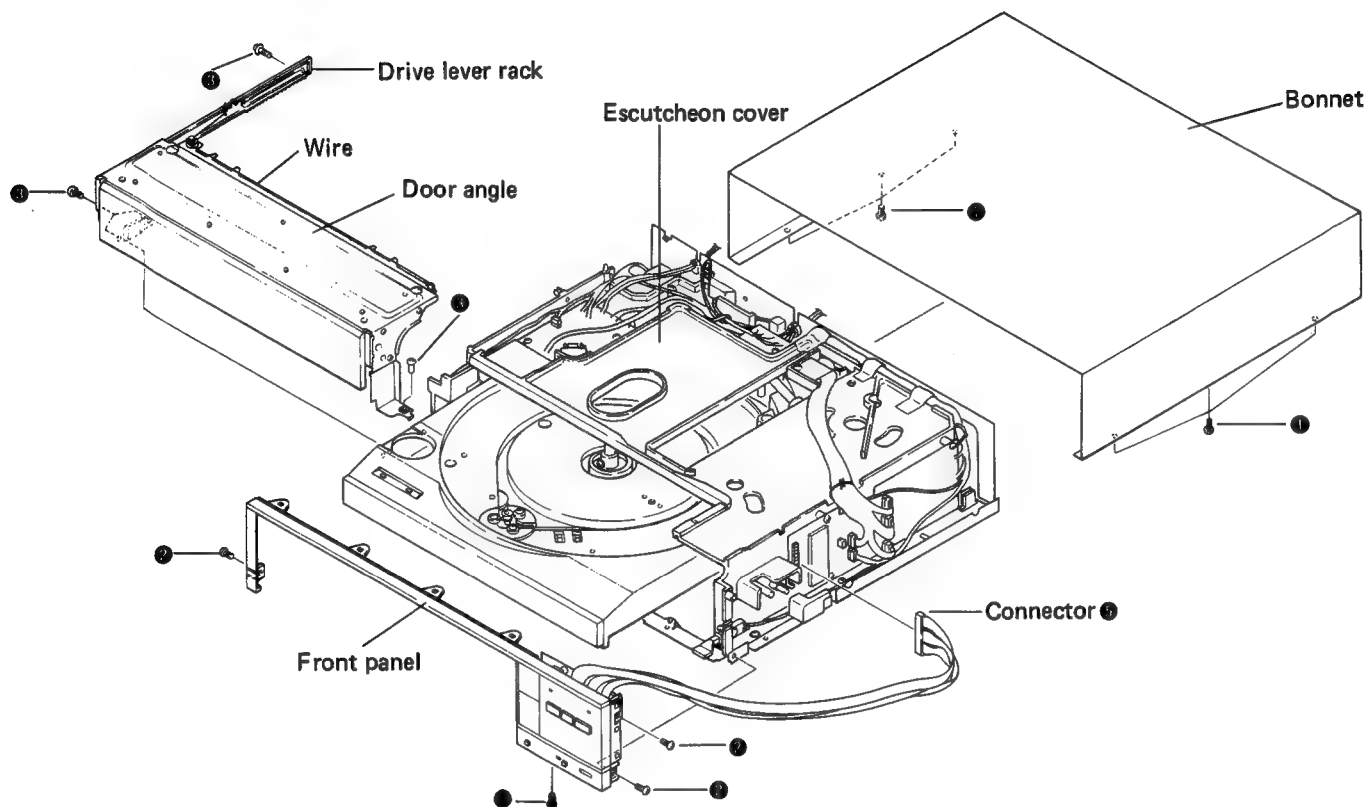


Fig. 1-19 Disassembly

3. Undo screws ❷ and remove the front panel (operation panel). This panel can be removed altogether if connector ❶ is disconnected.
4. Undoing screws ❸ enables removal of the door angle unit. Since the drive lever rack for opening the door engages the main gear in this door angle unit, perform this operation with due care (see Fig. 1-20).
The wire supporting the left hand side of the door when the door is opened and closed is wound once around each pulley and fixed to point A shown in Fig. 1-20 to ensure adequate tautness in the wire.
5. Undo screws ❹ and carefully lift the escutcheon cover upwards to remove it.
Disconnect all connectors shown in Fig. 1-21 at this time. And since the tonearm is pushed back with considerable force, be especially careful when removing the escutcheon cover.

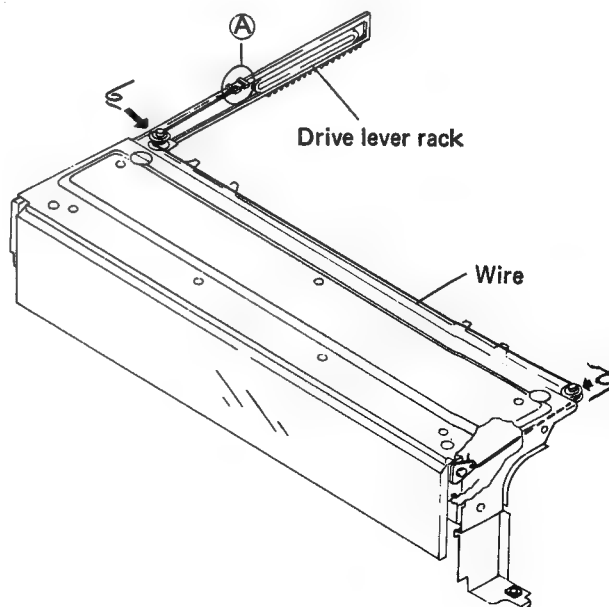


Fig. 1-20 Door angle Ass'y

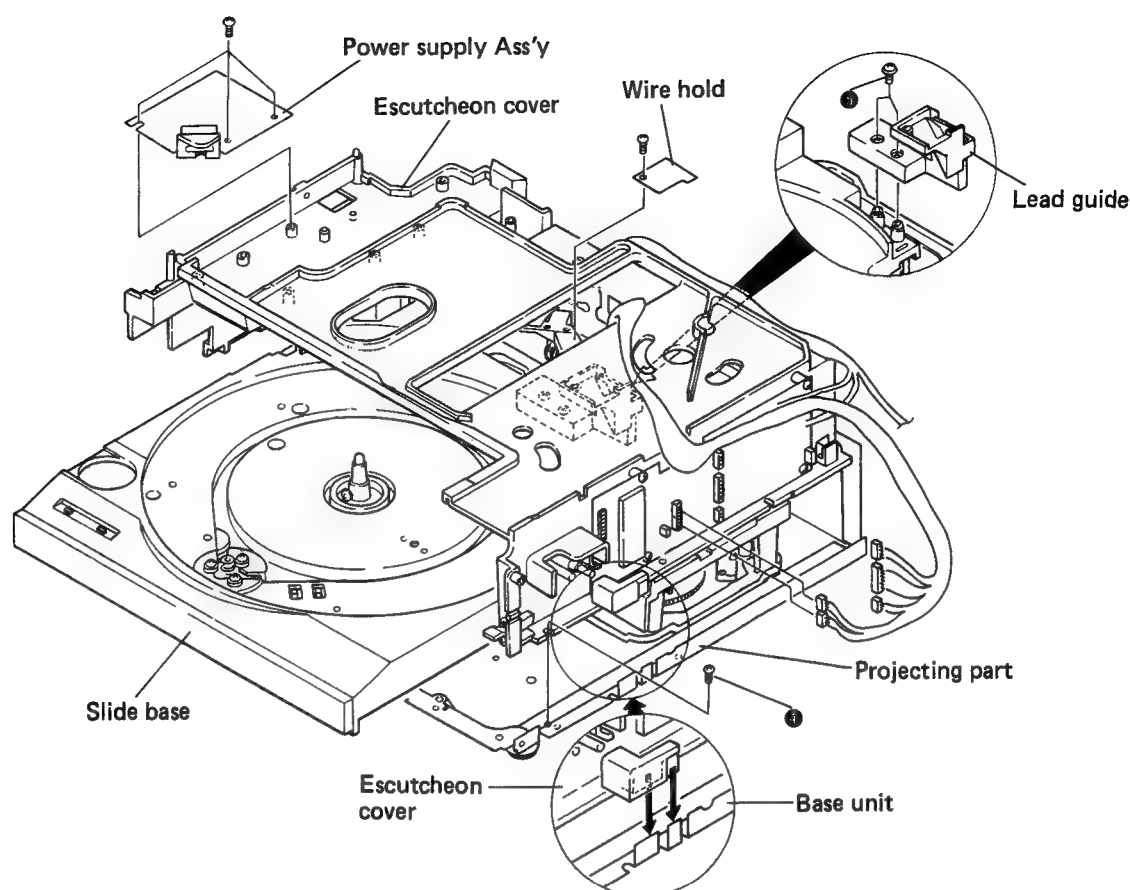


Fig. 1-21 Disassembly

■ Mounting the Escutcheon Cover

1. Pull the slide base out sufficiently to prevent the escutcheon cover from pressing against the tonearm head shell when re-mounting the cover.
2. Replace the escutcheon cover so that the sides slip over the projecting parts of the base as shown in Fig. 1-21, and then secure by screwing in screws ①. Check that the slider pin has entered the lock plate hole at this time (see Fig. 1-22).

■ Mounting the Door Angle Unit

1. Push the slide base back into its normal position, and align the front of the base with the front of the door (see the section on normal inserted slide base position adjustment). After properly engaging gear (F) with the drive lever rack, screw in the relevant screws.
2. After completing the adjustment, check for normal operation, making sure that there is no delay in door movement due to gear backlash.

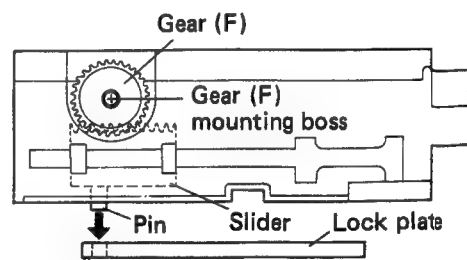


Fig. 1-22 Mounting the escutcheon cover

■ Mounting Gear (F)

1. With the slide base in normal position, check that the front of the base is flush with the front of the door. (If not flush, see the normal position adjustment).
2. Then while pushing the drive lever rack and slider towards the front panel, insert gear (F) into the escutcheon cover gear (F) mounting boss. Be careful not to push the slider too firmly (towards the front panel) since the slide base cover might also move.
3. Secure gear (F) by screwing in the relevant screws. After tightening the screws, press against the top of the door to check that the door is not loose.

■ Normal Inserted Slide Base Position Adjustment

- A. Electrically, the normal slide base position is determined by the slide base pressing against a position detector switch, resulting in the drive motor being switched off.
- B. Mechanically, however, the slide base is stopped when it strikes against a stopper screw at the back of the turntable.
- C. The normal slide base position can thus be changed by adjusting this stopper screw.
- D. This adjustment simply involves turning the adjustment screw from the rear of the turntable as shown in Fig. 1-23. A full turn of the screw changes the slide base position by about 0.5mm.

6. Undo screws ⑤ and remove the lead guide. Then without applying too much force, carefully disconnect the leads from the tonearm and other parts.
7. Remove the tonearm section by undoing screws ⑥.

■ Tracking Force Adjustment

1. With the gap between the tonearm and balance weight set to 4.7mm as shown in Fig. 1-24, tighten the weight in that position.
2. Using a tracking force gage, check that the tracking force is $2 \pm 0.3g$. The tracking force in this turntable is fixed at 2g.

■ Mounting the Tonearm Base

The tonearm mounting position is outlined in Fig. 1-24. Align the tonearm base mounting screw with the groove in the tonearm ass'y pivot bearing, and then tighten the screw.

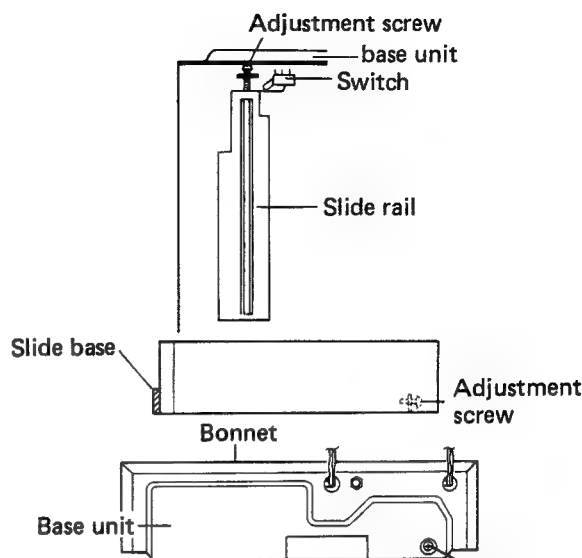


Fig. 1-23 Normal inserted slide base position adjustment

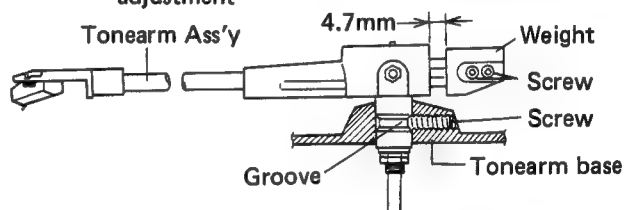


Fig. 1-24 Tracking force adjustment & Mounting the tonearm base

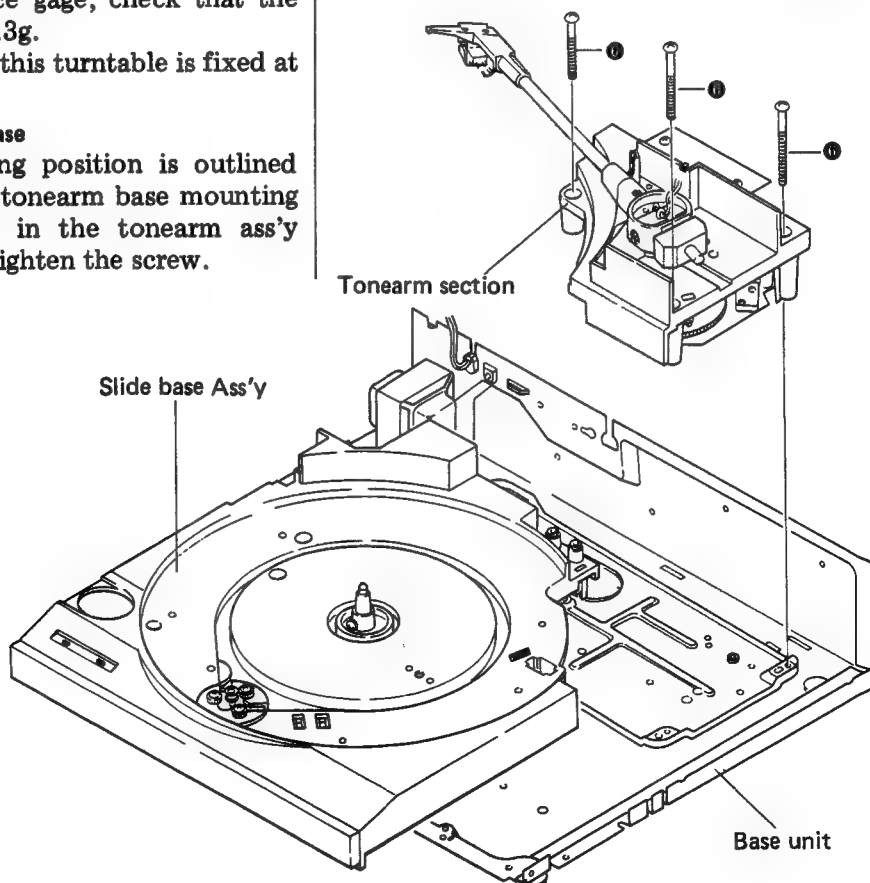


Fig. 1-25 Disassembly 3

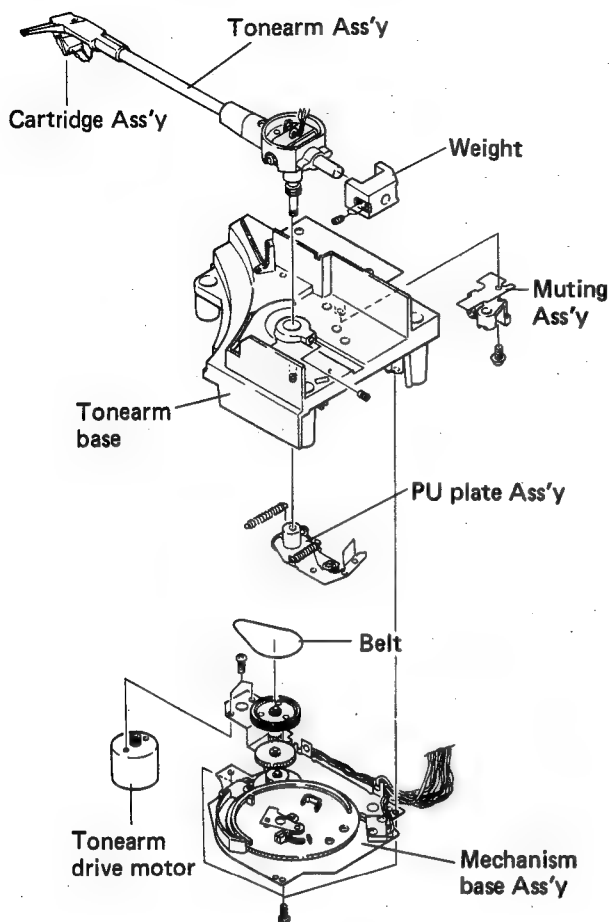


Fig. 1-26 Disassembly 4

■ Mounting the PU Plate

With the tonearm placed in the arm rest, position and secure the PU plate so that the center of the adjustment cam is perfectly horizontal (see Fig. 1-27).

■ Mounting the Index Cam

1. First apply grease (GP-574) to the assist lever, and then insert the lever so that the index pin is aligned with the assist lever window (see Fig. 1-28).

Apply the grease as shown in Fig. 1-29.

2. Insert the assist lever with the index cam into the tonearm base, and secure by screw. Check that the assist lever pin properly meets the set spring during this operation. The set spring must not fail to meet the pin, and must not strike against the base of the pin (see Fig. 1-30).

■ Mounting the Mechanism Base

1. With the lead-in latch of the mechanism base ass'y open, align the hole in the drive plate with the gear (see Fig. 1-31).

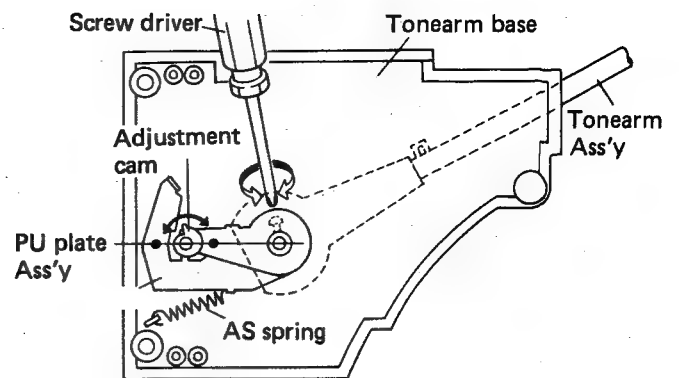


Fig. 1-27 Mounting the PU plate

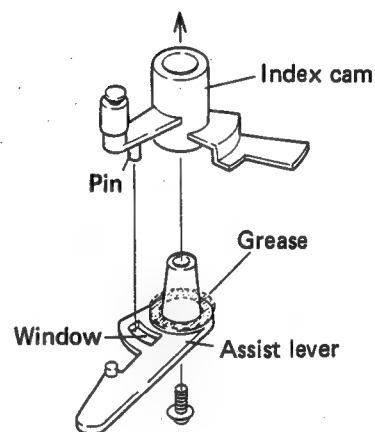


Fig. 1-28 Mounting the index cam 1

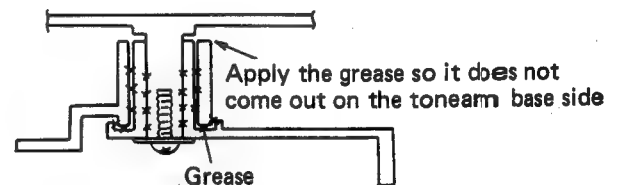


Fig. 1-29 Apply the grease

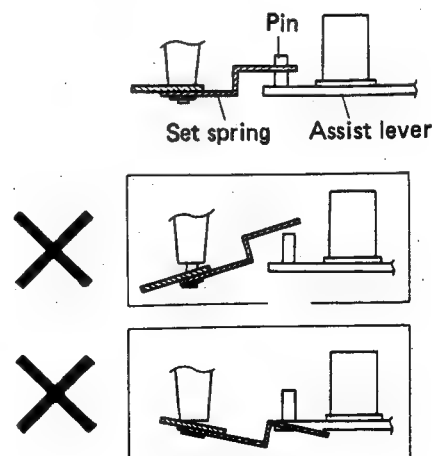


Fig. 1-30 Mounting the index cam 2

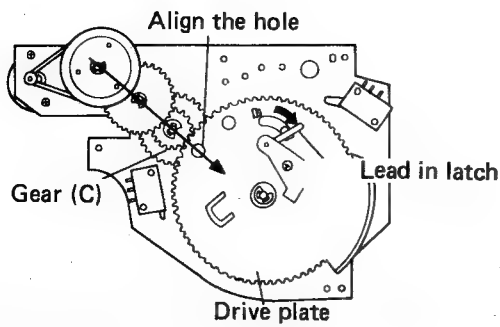


Fig. 1-31 Mounting the mechanism base 1

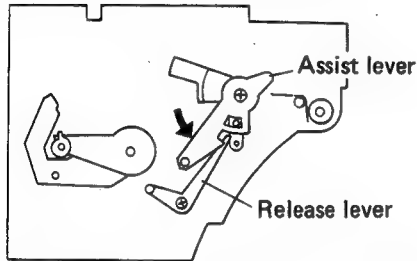


Fig. 1-32 Mounting the mechanism base 2

2. Push the assist lever in the direction of the arrow, and with the tonearm placed in the arm rest, mount the mechanism base (see Fig. 1-32).

8. The slide base section can be removed after screws ⑦, are undone. And the motor which drives the slide base is located underneath the base.

9. Undo screws ⑧ to remove the slide base cover.

10. The slide rail can be disassembled after screws ⑨ are undone. Do not lose any of the bearings during this operation.

- Since "Mounting the Slide Base" and "Slide Rail Assembly" are the same as for PL-88F, refer to those sections for mounting of these parts.

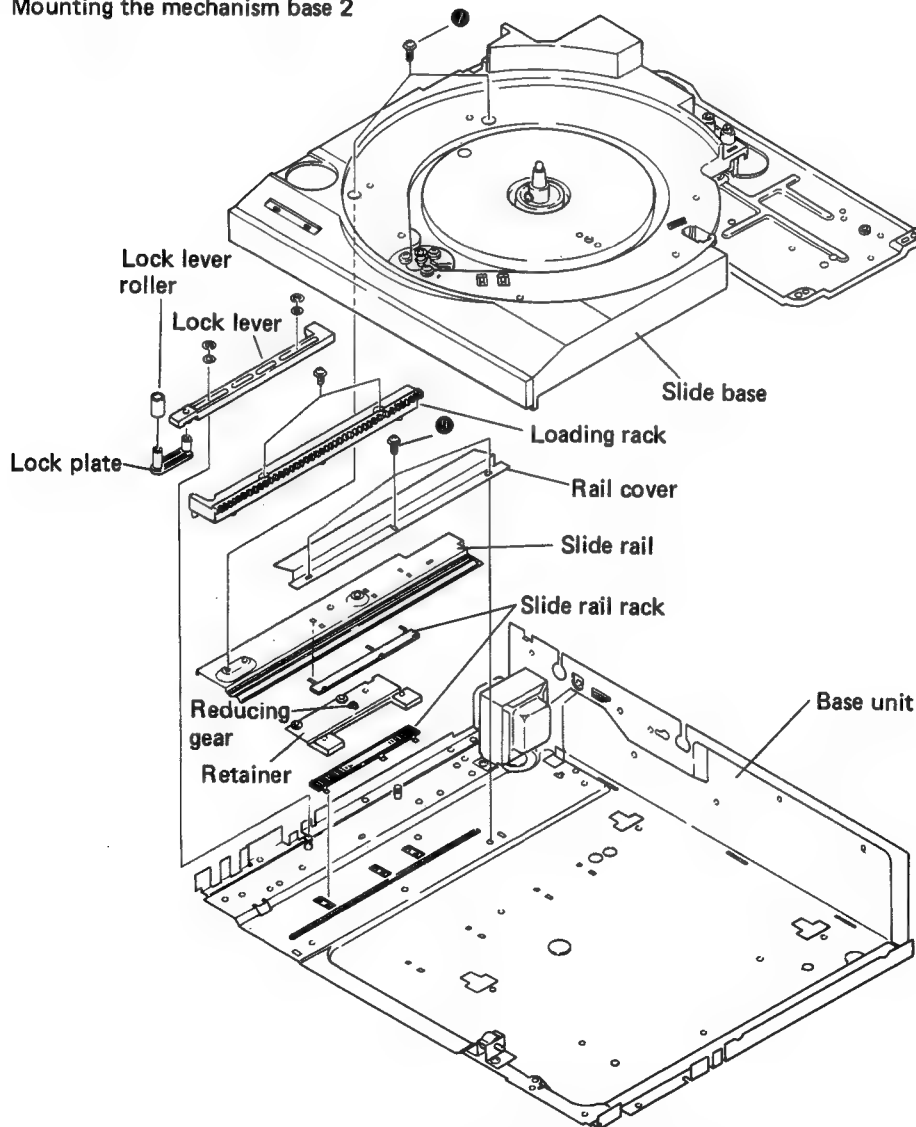


Fig. 1-33 Disassembly 5

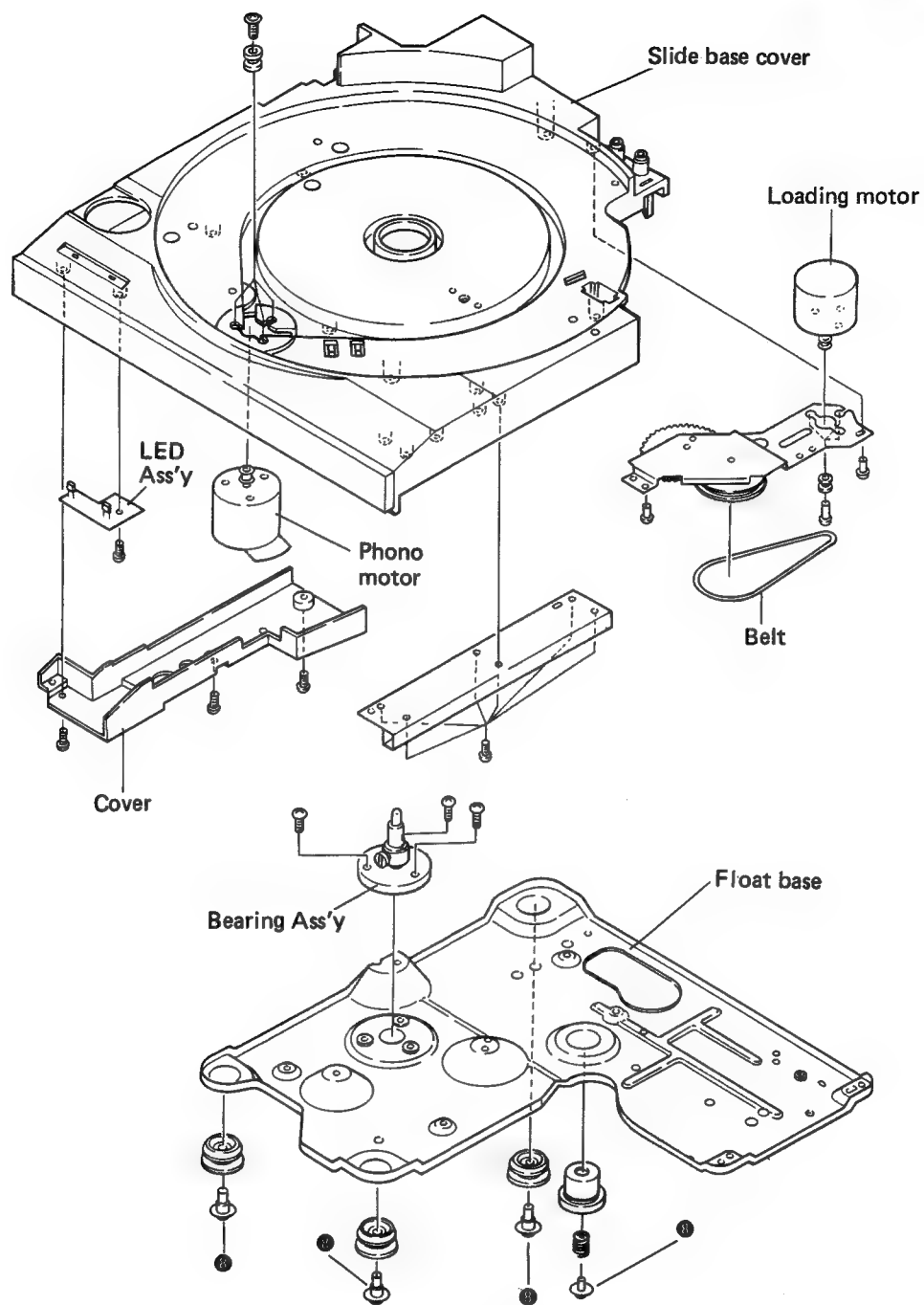


Fig. 1-34 Disassembly

2. OUTLINE OF MECHANICAL OPERATIONS

Apart from one or two places, major mechanical operations in the PL-88F, PL-44F, and PL-05 are basically the same.

Main differences:

1. Whereas tonearm drive in the PL-88F is by DD motor from the center spindle to the outer circumference of the record, operation in the PL-44F and PL-05 is by tonearm drive motor alone.
2. When the stylus is lowered onto and lifted away from the record in the PL-88F, the cartridge output is switched off electrically. In the PL-44F and PL-05, on the other hand, the cartridge output is switched on and off by a muting switch which also serves as the DOWN switch.

The operation outlined in this manual refers to the PL-44F and PL-05 models.

2.1 SLIDE BASE OPERATION

■ Loading Out Operation

1. When the OPEN/CLOSE key is pressed, the slide base drive motor mounted on the slide base cover commences to turn (see relevant circuit description).
2. This motor drive is transmitted via motor pulleys, belt, and gear (D) to gear (E). Gear (E) in turn engages the loading rack mounted on the base.
3. The slide base cover is mounted on a slide rail capable of moving in and out over steel bearings. The slide base cover is moved forward when the slide base drive motor rotates clockwise.
4. When the slide base cover is moved forward by about 170mm, a projection on the slide base cover presses against a detaching switch via a rubber stopper to stop the slide base drive motor (see relevant circuit description).

■ Door Operations

1. The door is opened by the slide base cover moving forward.
2. When the slide base is in the normal inserted position, the lock lever at the back is pulled forward by the U-shaped section of the slide base cover and the wall of the loading rack (see Fig. 2-1).
3. When the lock lever and lock lever roller are moved by about 25mm, the lock lever roller falls into the U-shaped section of the lock lever, thereby halting the lock lever and lock plate (again see Fig. 2-1).
4. The movement of the lock plate, however, is amplified by slide gear (F) to a stroke of about 50mm, thereby raising the door via the drive lever rack (see Fig. 2-2).

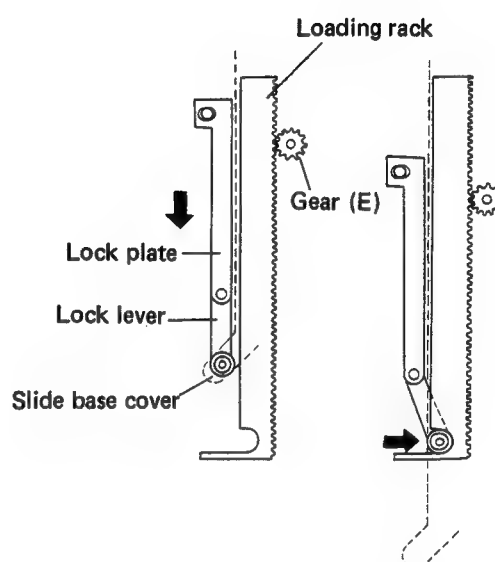


Fig. 2-1 Loading out operation

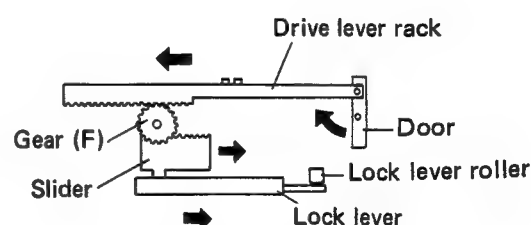


Fig. 2-2 Door operation 1

5. The left hand side of the front door is lifted directly by the drive lever rack, and the right hand side via a wire connection (see Fig. 2-3).
6. The front door movement is guided by the door holder and holder spring. Pin (A) of the door is passed to the top of the door holder, while pin (B) is passed to the groove along the bottom of the holder and to the bottom of the holder spring (see Fig. 2-4).
7. The door is closed again by the force of the drive lever rack and the door holder spring.

■ Loading In Operation

1. When the OPEN/CLOSE key is pressed, the slide base drive motor is rotated in the opposite direction to the loading out operation, resulting in the slide base being pulled back into the main turntable housing (see relevant circuit description).
2. When the slide base is pulled back into the normal inserted position, a storage switch is pressed (delay time of about 130msec.) and the motor stopped to complete the loading in operation. In actual practice, however, the slide rail is halted when it strikes an adjustment screw before the motor is stopped (see Fig. 2-6).

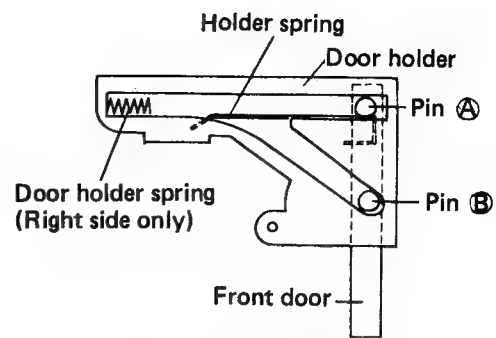


Fig. 2-4 Door operation 3

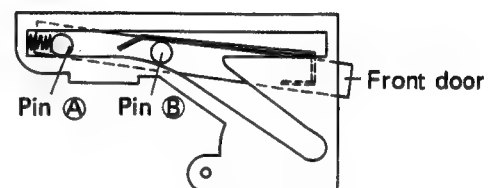


Fig. 2-5 Door operation 4

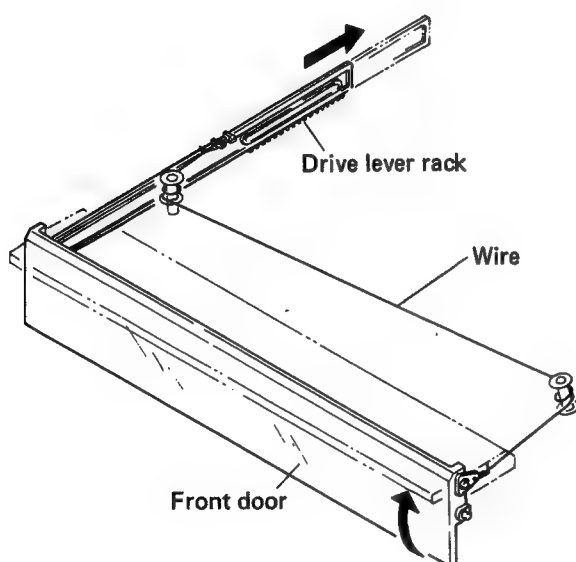


Fig. 2-3 Door operation 2

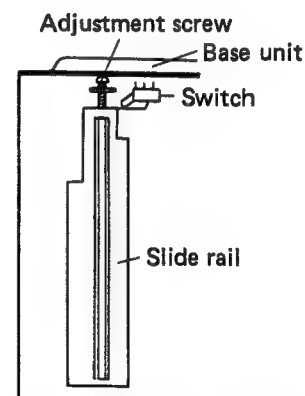


Fig. 2-6 Loading in operation

2-2 TONEARM AUTO PLAY OPERATION

■ Role of the Operation Plate

1. The operation plate is aligned with the PU plate pin and forms a pair with the lead-in latch under constant pressure, resulting in horizontal movement of the tonearm.
2. Vertical tonearm movement is achieved by raising and lowering the EV sheet due to the slope in the upper surface of the plate.
3. The index cam is set and reset by a U-shaped projection on the surface of the plate. This is used in record size selection.
4. Depending on the outer wall, press switches in concert with the rest, up, and down positions.

■ Auto Lead-in Operation

1. When the START/STOP key is pressed, the tonearm drive motor rotates clockwise, and in turn drives the drive plate counter clockwise via gears (A), (B), and (C) (see Fig. 2-7 and relevant circuit description).
2. The drive plate has a torque equivalent to about 20g when converted to tracking force, and mounts a lead-in latch which can be opened and closed. When the PU plate pin is caught in this latch, that plate is rotated in the same direction as the drive plate.
3. Since the PU plate is attached to the tonearm, PU plate movement is converted into horizontal tonearm movement (see Fig. 2-9).
4. At the same time that the drive plate turns the PU plate, the assist plate is moved by the U-shaped projection, and the index cam is set to the size of the record to be played (again see Fig. 2-9).
5. If a 17cm record is placed on the turntable platter, the index cam is thrown right out by assist lever movement, and the larger index cam fan shape is set in the PU plate locus.

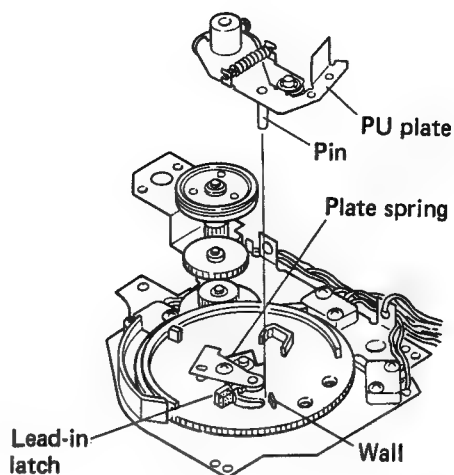


Fig. 2-8 Auto lead-in operation 2

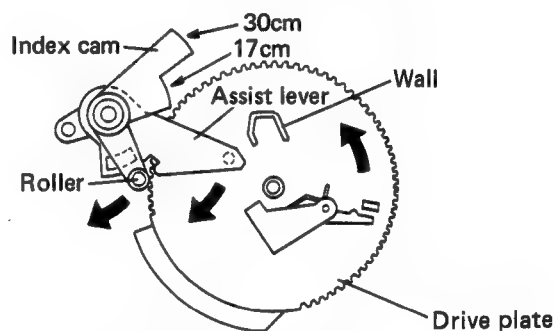


Fig. 2-9 Index cam position

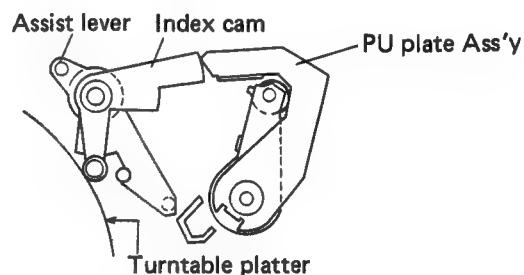


Fig. 2-10 17cm position

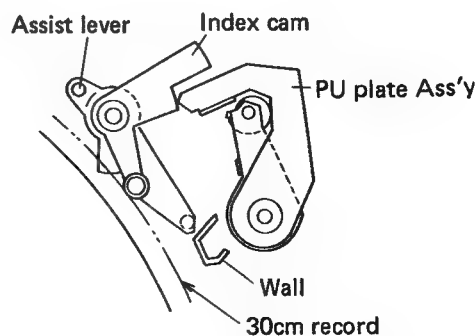


Fig. 2-11 30cm position

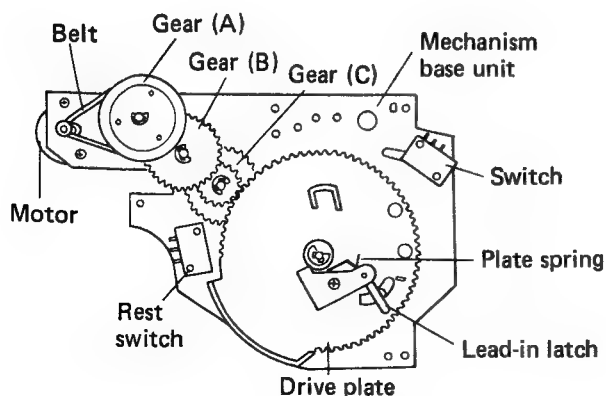


Fig. 2-7 Auto lead-in operation 1

6. If, on the other hand, a 30cm record is placed on the turntable platter, the roller in the index cam is pushed out by the edge of the record, and the smaller index cam fan shape is set in the PU plate locus (see Fig. 2-12).
7. When the drive plate rotates together with the PU plate, the PU plate meets the index cam described above. Since the drive plate continues to rotate, the PU plate inverts the lead-in latch before stopping.
8. In this status, the fold with the drive plate is released with the tonearm at the position of the lead-in groove for the specified record size, making the tonearm ready for play.
9. With the drive plate rotating further, the release lever is pressed by the U-shaped projection, and the index cam is moved back by the assist lever.

With a 30cm record, the index cam makes contact with the record through the roller. Since this likely to interfere with playback operation, the cam is moved back out of the way before start of play.

The drive plate continues to rotate, pressing against the UP switch (see Fig. 2-13).

10. With further drive plate rotation, the EV shaft drops down the slope in the drive plate, resulting in the tonearm starting to lower onto the record.
11. After the tonearm has been fully lowered onto the record, the drive plate pushes against the muting switch. In addition to switching the muting switch off, the tonearm drive motor is also stopped (see Fig. 2-13 and relevant circuit description).

■ Up/Down Operation

1. The tonearm drive motor is started by pressing the ARM ELEVATION key. The direction of motor rotation is determined by the ON/OFF status of the UP and muting switches.
2. Furthermore, the muting and UP switches can also be used for simple up and down operation of the EV involving motor operation (drive plate operation) only at the sloping section of the drive plate.

■ Return Operation

1. When the end of the record is detected during record play (see relevant circuit description), the tonearm drive motor is rotated counter clockwise, and the drive plate is rotated clockwise via a reducing gear (same operation as when the START/STOP or OPEN/CLOSE key is pressed).

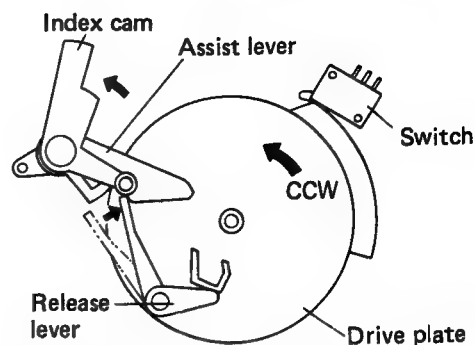


Fig. 2-12 Auto lead-in operation 3

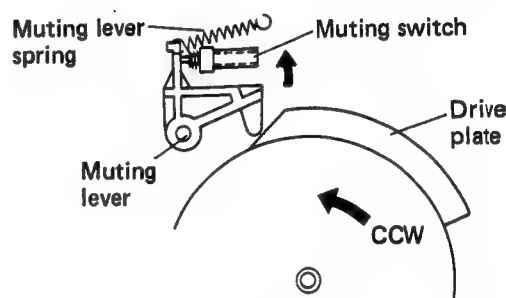


Fig. 2-13 Auto lead-in operation 4

2. The EV sheet is forced up at the slope in the drive plate, thereby raising the tonearm.

The return projection on the drive plate pushes against the PU plate pin to move the tonearm in the return direction (see Fig. 2-14).

3. As the drive plate continues to rotate, the lead-in latch is pushed back to the raised portion of the mechanical base, inverted, and then catches the pin on the PU plate.

4. At the same time, the index cam is also reset. The assist lever is pushed by the drive plate projection, and the accompanying index cam is also pulled in.

5. The index cam is stopped by the tonearm base pin serving as a stopper. Since the assist lever continues to rotate, the index cam is positioned in front of the assist lever in a relative inter-relationship (see Fig. 2-15).

6. After the drive plate has rotated further, the index cam and assist lever are reset by the set spring to the original positions (see Fig. 2-15).

7. The drive plate still rotates further and pushes against the rest switch. This halts the tonearm drive motor to bring all operation to a stop.

■ PL-88F Tonearm Operation

In the PL-88F, the tonearm drive motor moves the tonearm to a position a little past the center spindle. All subsequent tonearm movements are controlled by a "double eye" sensor and the DD motor.

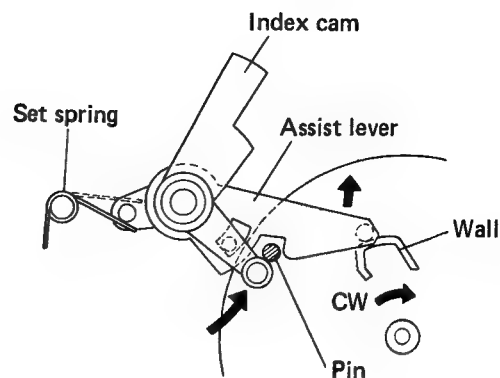


Fig. 2-14 Return operation 1

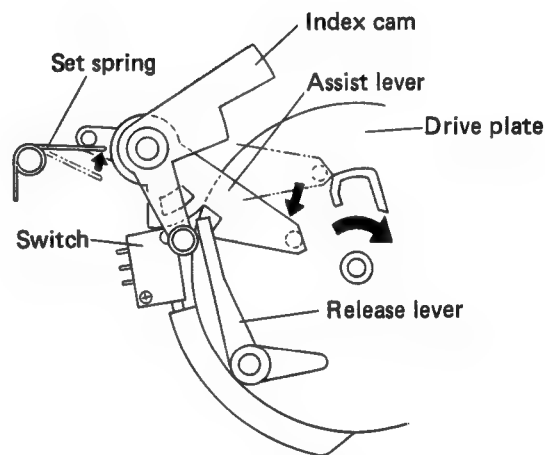
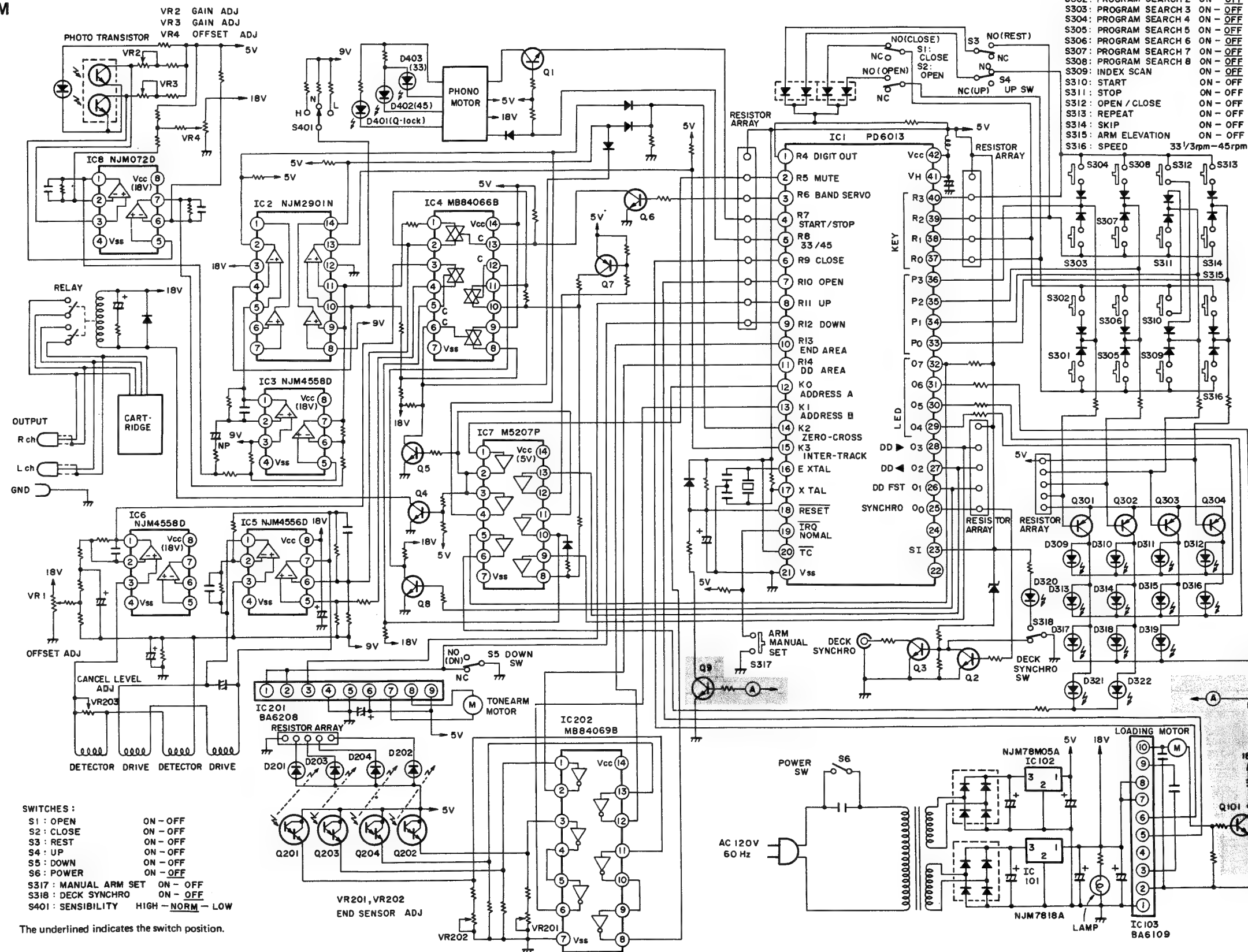


Fig. 2-15 Return operation 2

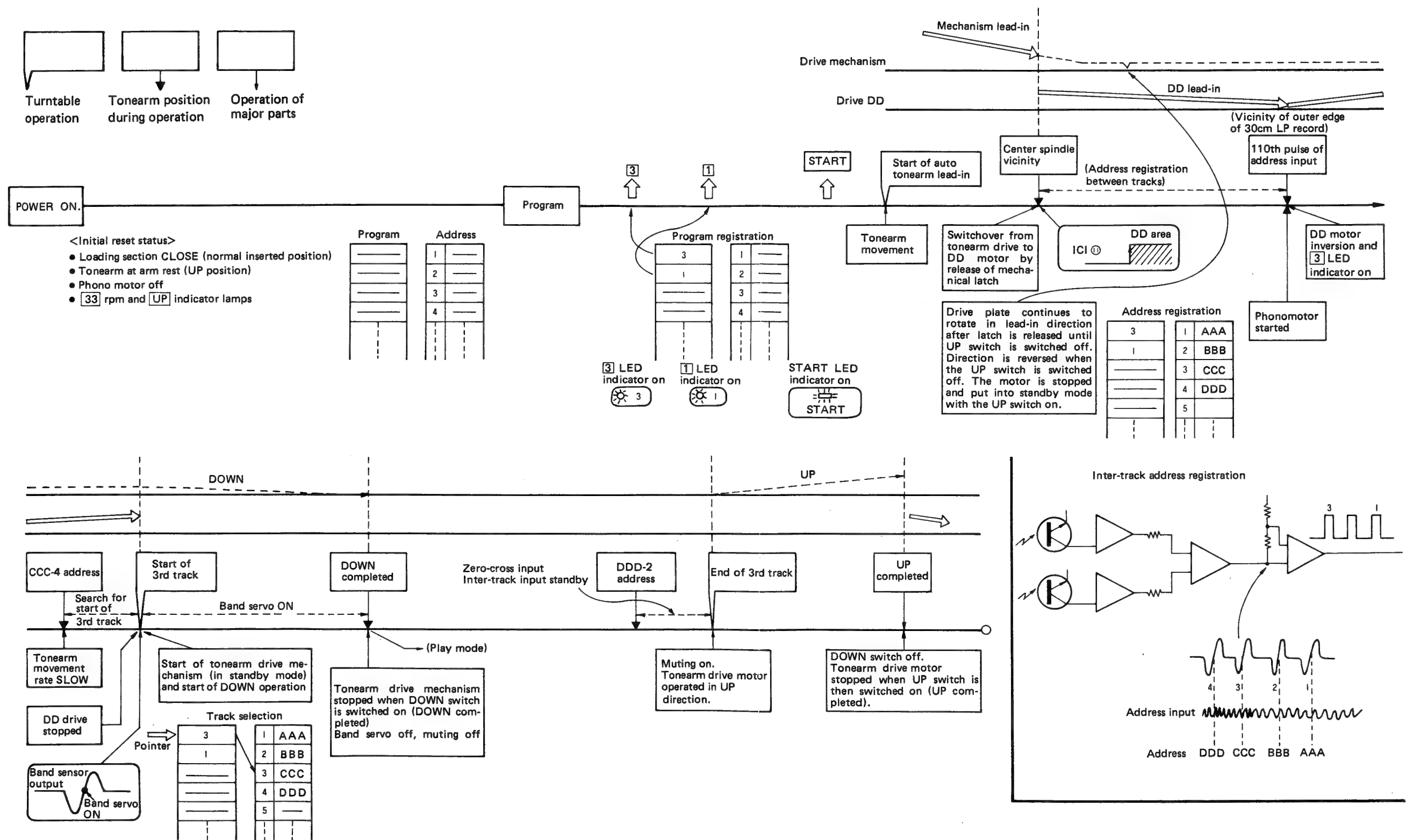
3. CIRCUIT DESCRIPTION(PL-88F)

■ BLOCK DIAGRAM

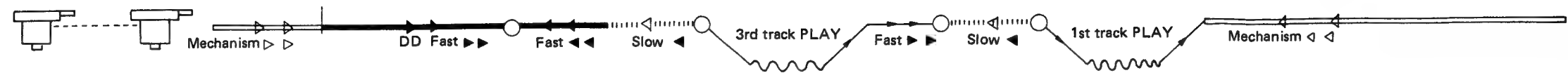


Shaded parts are found only on KU type models.

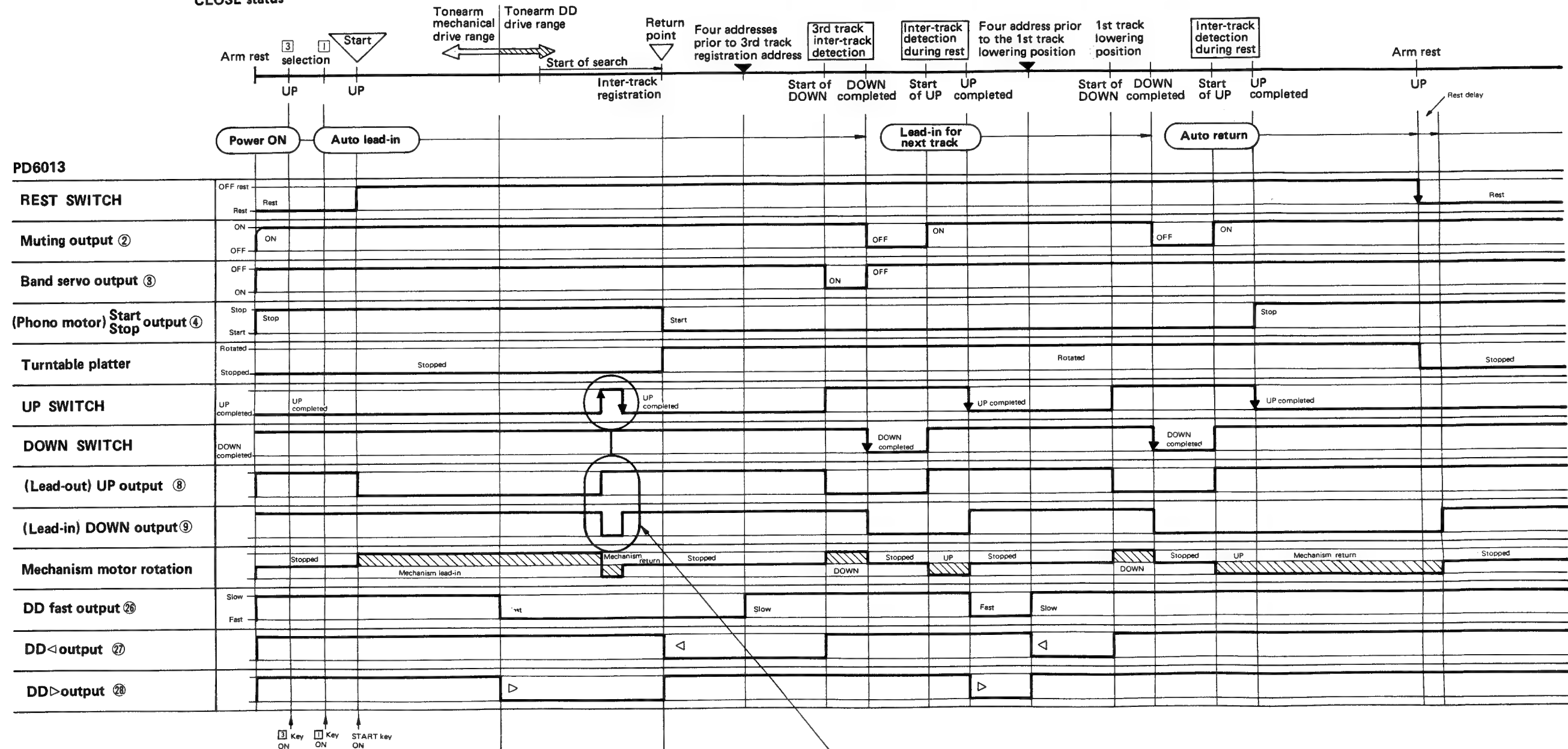
■ Operation Chart



■ **Timing Chart**
Program Selection Play Operation Cycle
from 3rd Track to 1st Track

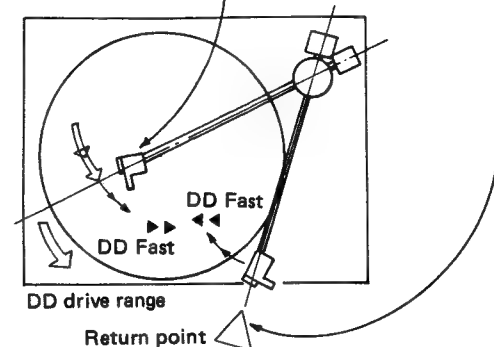


CLOSE status

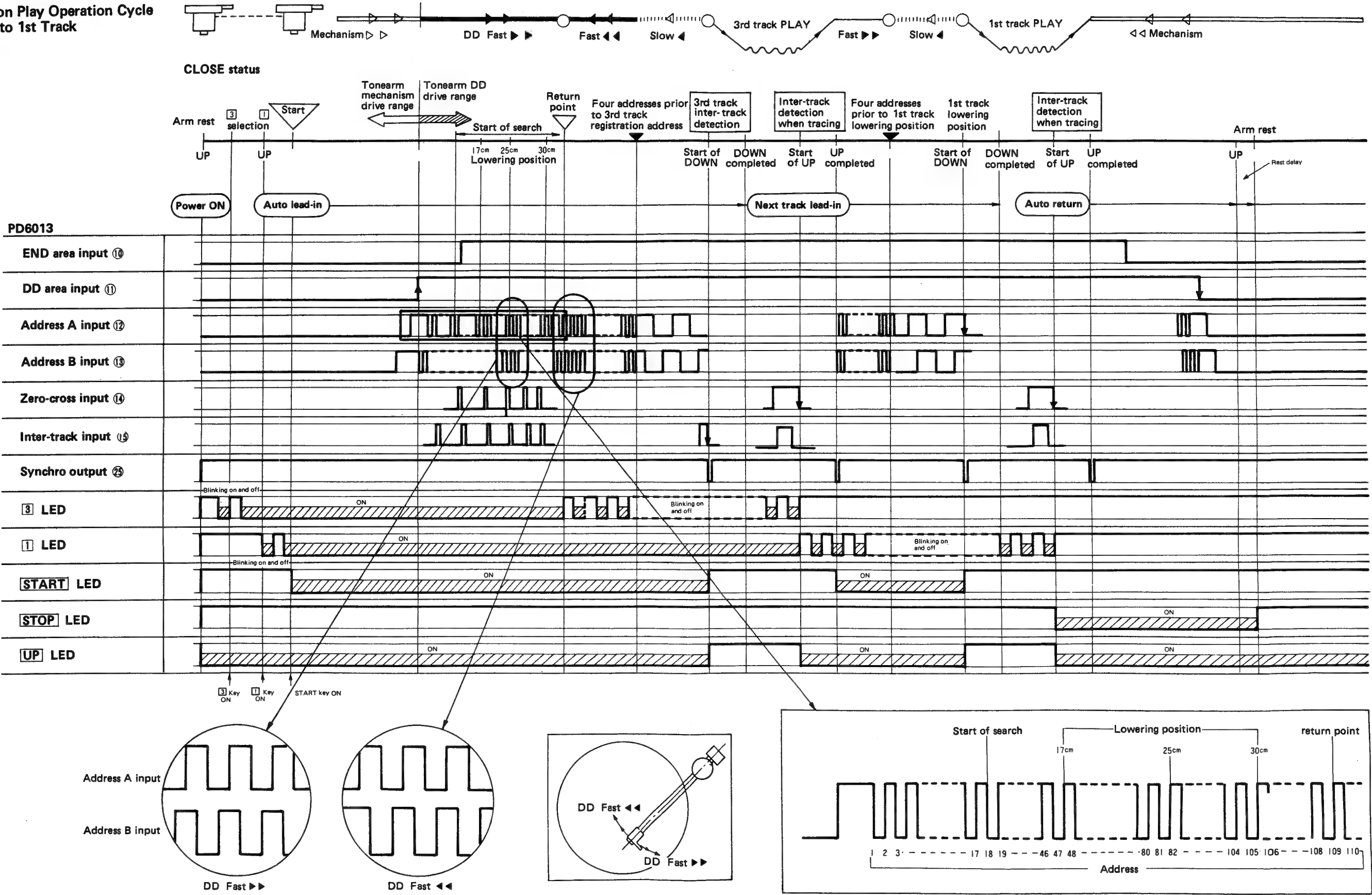


EV UP stop process

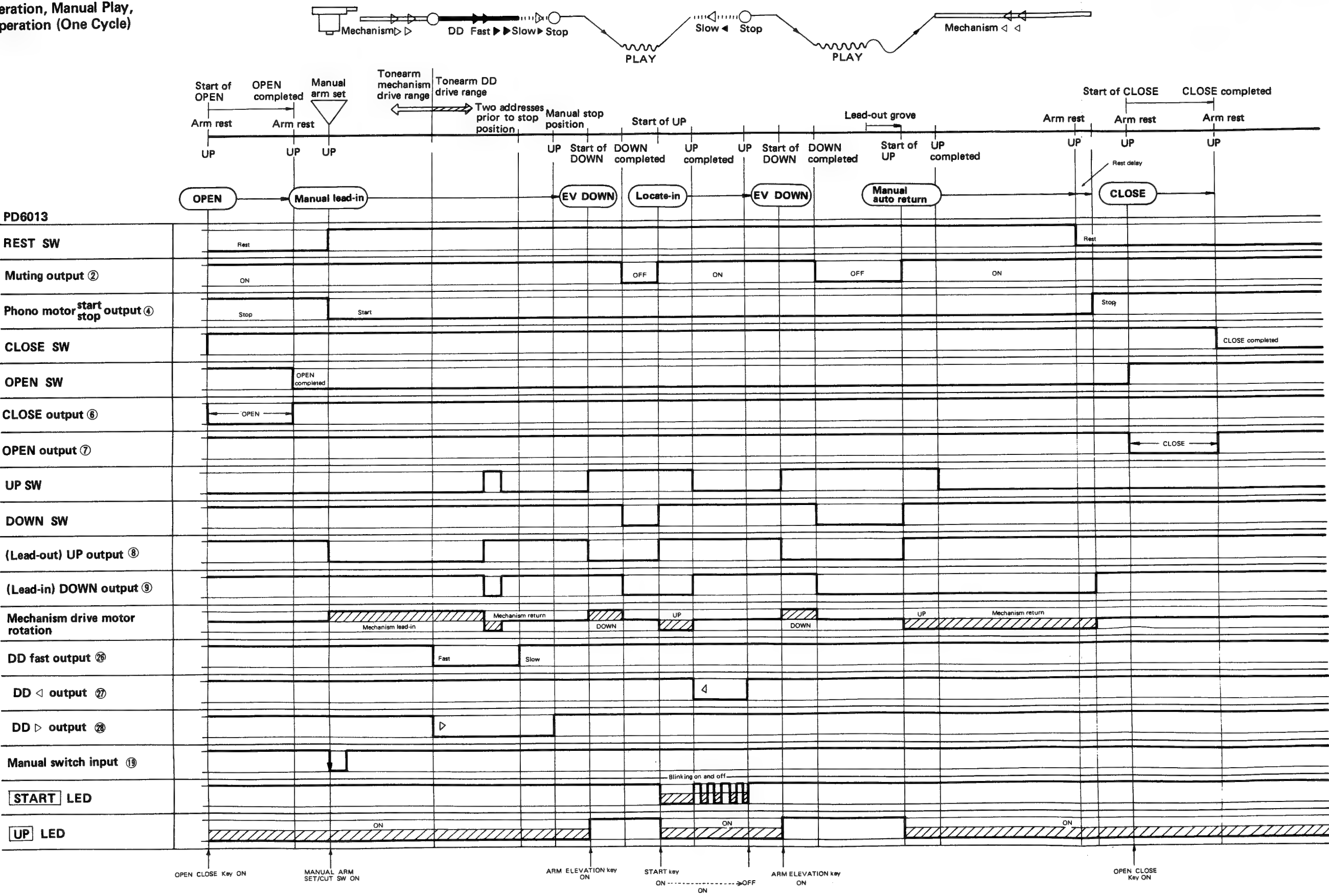
Since the one mechanism motor handles mechanism lead-in and lead out, and UP and DOWN, this motor rotates ahead after entering the DD drive range and DD lead- in is started. The mechanism motor is switched to standby with UP completed ready for the next UP/DOWN operation.



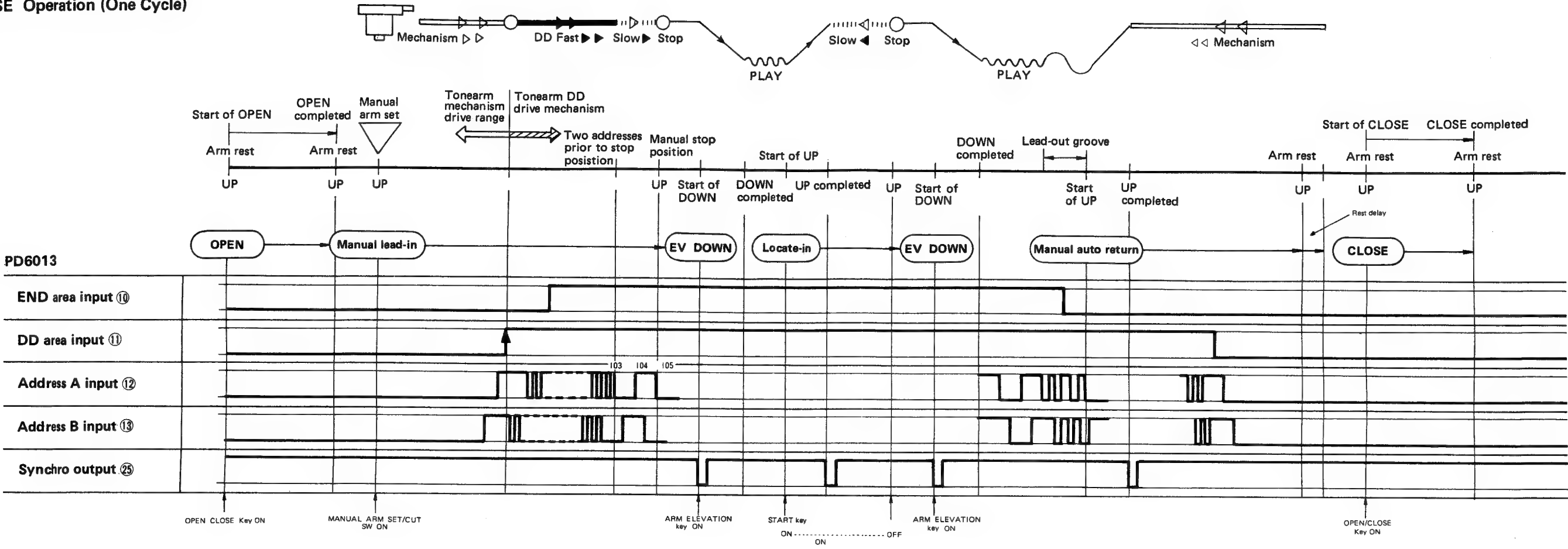
Program Selection Play Operation Cycle
from 3rd Track to 1st Track



OPEN Operation, Manual Play,
CLOSE Operation (One Cycle)

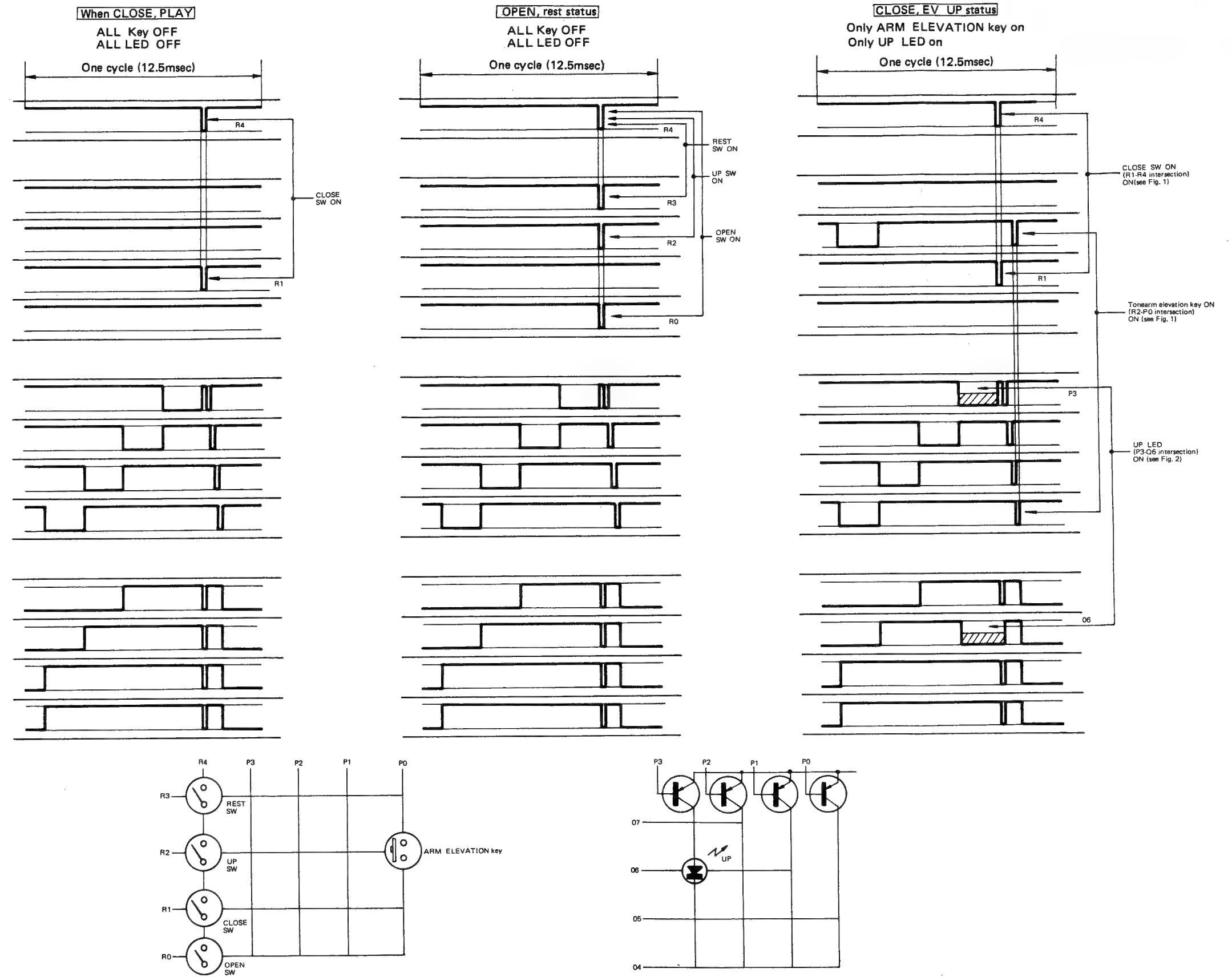


OPEN Operation, Manual Play,
CLOSE Operation (One Cycle)



Mechanism Digit Output, KEY Matrix,
LED Matrix (One Cycle)

PD6013	
Mechanism (SW) digit output R4 ①	
Key inputs	R3 ④⑩
	R2 ③⑨
	R1 ③⑧
	R0 ③⑦
Digit outputs	P3 ③⑥
	P2 ③⑤
	P1 ③④
	P0 ③③
LED outputs	O7 ③②
	O6 ③①
	O5 ③⑩
	O4 ③⑨



3.1 OPERATION OF MAJOR BLOCKS

See the block diagram in Fig. 3-1.

■ Band Sensor Section

- 1. Band sensor
This sensor consists of an LED and two photo-sensitive transistors built into the tip of the head shell.

Light beams from the LED are reflected off the record surface back into the photosensitive transistors, the amount of reflected light received being used to distinguish between sound track and inter-track areas. That is, this is an optical sensor designed to distinguish sound track area from inter-track area.

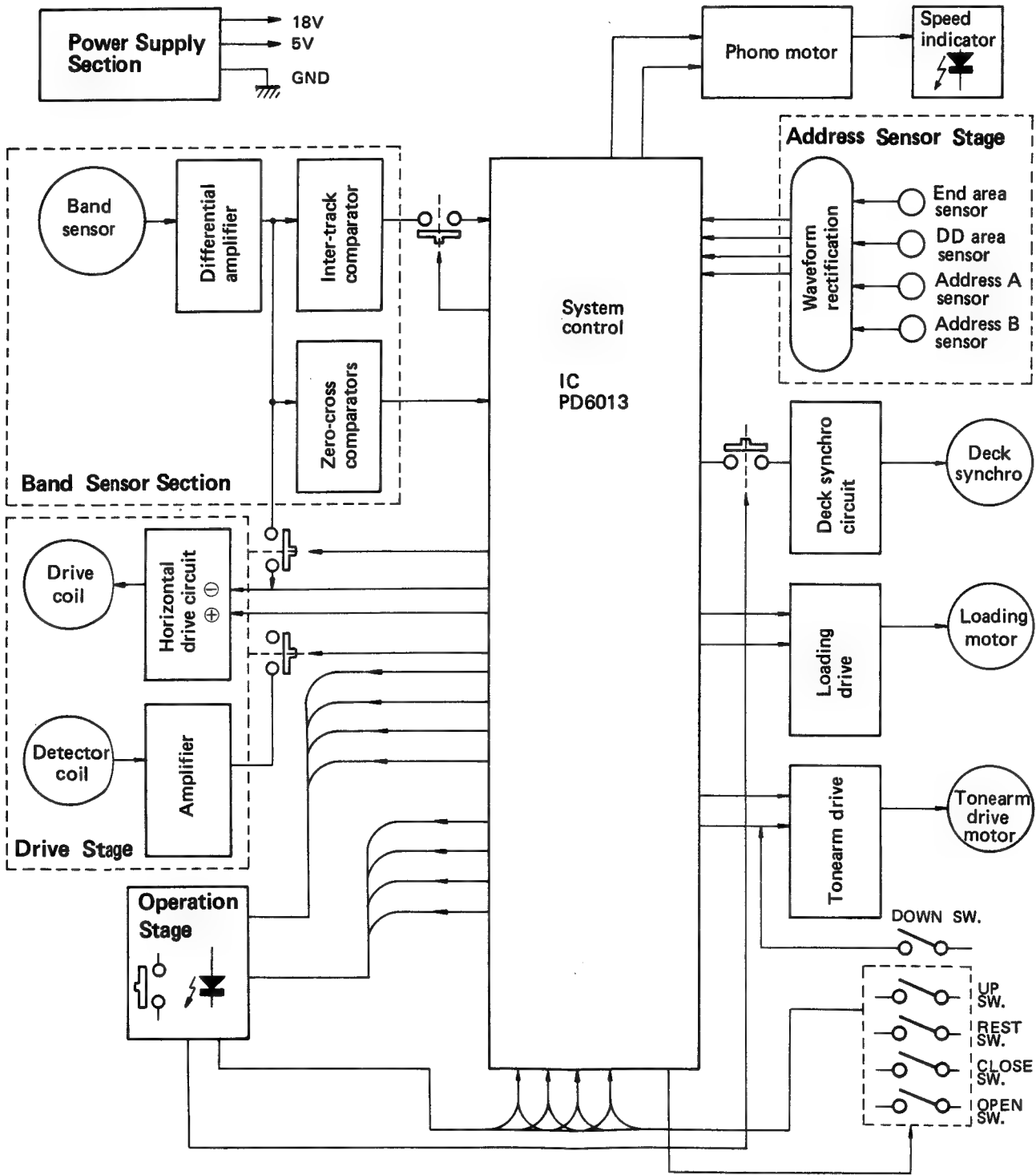


Fig. 3-1 Block diagram

2. Differential amplifier circuit

The small inter-track signal from the band sensor is amplified by differential amplifier, and passed to the inter-track and zero-cross comparators.

In addition, part of the amplifier output is also passed as a band servo signal to the (-) input of the tonearm horizontal drive circuit.

3. Inter-track comparator

Upon reception of the output from the band sensor and differential amplifier, signals whose levels are greater than the set VTH (threshold) level are passed as inter-track signals to the system control IC PD6013.

4. Zero-cross comparator

Upon reception of the amplified band sensor signal, inter-track center data is passed to the system control IC PD 6013 during play mode. By processing the inter-track and zero-cross comparator signals, the PD6013 detects the inter-track center during play mode.

■ Drive Stage

1. Horizontal drive circuit

This circuit is formed by a differential amplifier and an inverter (gain 1). The voltage differences in the (-) and (+) input signals in respect to a reference voltage are amplified, the current being passed through the coil being used to drive the tonearm.

2. Amplifier circuit

The small voltage from the detector coil is amplified, and then applied as a speed servo signal to the (+) input of the horizontal input of the horizontal drive circuit.

■ Control Stage

1. Operation stage

This stage includes the operating switches and indicators involved in program selection.

2. Tonearm drive stage and loading drive stage

Interface for reception of signals from the system control IC(PD6013), and activation of the tonearm and loading drive motors.

3. Deck synchro circuit

Interface circuit for generating tape deck (recording mode) synchro signals.

4. System control IC PD6013

4-bit microcomputer for centralized control of turntable functions. The operation stage handles MATRIX KEY SCAN and LED dynamic switching.

■ Address Sensor Stage

1. Waveform rectification

Following inversion and rectification of signals from the sensors, output data (indicating tonearm position) is passed to the system

control IC.

2. Address sensor

Consisting of four LED/phototransistor pairs incorporated underneath the tonearm, pulse signals generated by slits in the shutter coupled to the tonearm are passed to the system control IC. In this way, the end area, DD area, and addresses are detected.

3-2 CONTROL STAGE

The control stage consists of a system control IC PD6013 (IC1), a loading motor drive IC BA6109 (IC103), a tonearm drive IC BA6208 (IC201), an operating stage (switches and LED indicators), a muting relay, a drive stage interface, and other component circuits (resonator, reset circuit etc) (see Fig. 3-2).

During the operation description, mention is also made of an analog switching IC (IC4), a comparator IC (IC2), a tonearm drive amplifier IC (IC5), a buffer amplifier IC (IC7), and a waveform rectifier IC (IC202).

3.2.1 When the POWER switch is Switched ON

When the power is switched on, the turntable is set to the following status irrespective of the mode settings when the power was switched off.

Initialized reset status

- Loading stage is set to "CLOSE" and "normal inserted position".
- If OPEN had been completed before the power was switched on, that OPEN status is maintained when the power is switched on.
- Tonearm is in the arm rest in "UP status".
- Phono motor is stationary.
- The [33] rpm LED (D403) and [UP] LED (D317) light up.
- The IC1 (PD6013) logic is as outlined below.

1		12	L	23	H(5V)	34	
2	H	13	L	24		35	
3	H	14	—	25	H	36	
4	H	15	—	26	H	37	*
5	H	16	—	27	H	38	* H
6	H	17	—	28	H	39	
7	H	18	H	29		40	
8	H	19	H	30		41	H(5V)
9	H	20	H(5V)	31		42	5V
10	L	21	L(GND)	32			
11	L	22		33			

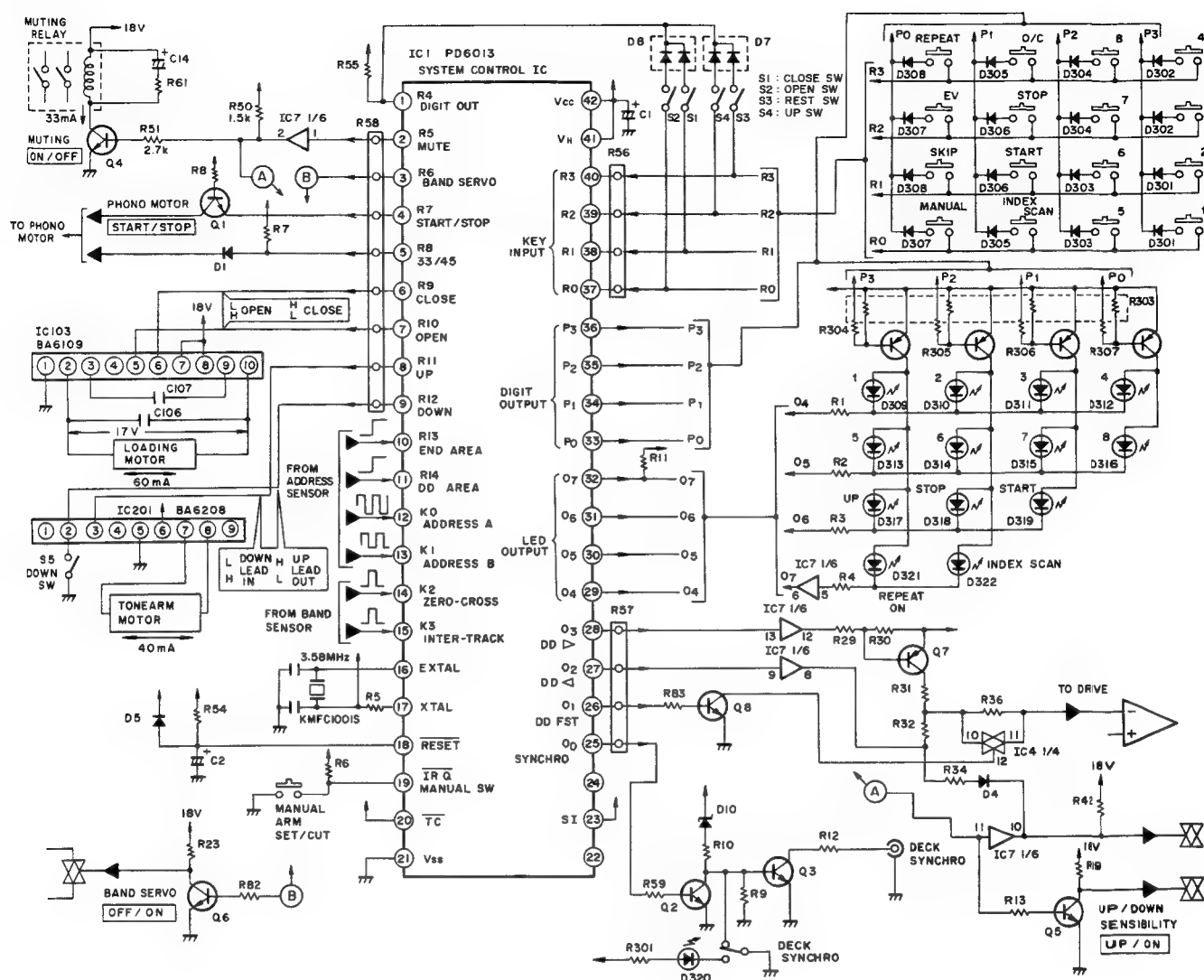


Fig. 3-2 Control circuit

- IC1 PD6013

Fail Safe Function

1. Slide operation






























OPEN or CLOSE operation is started, but an error is generated if that operation is not completed within 25 seconds \pm_{100}^{+0} msec. This results in blinking of the START and STOP indicators, and stopping of the slide, EV, and phono motors.

2. Lead-in during manual mode

- If the tonearm does not enter the address count area within nine seconds after manual key operation, manual mode is cancelled, and the tonearm returned.
- After the tonearm enters the address count area, locating is disabled for one second. If the tonearm leaves the address count area during this one second period, manual mode is again cancelled, and the tonearm returned.

- If the tonearm does not proceed to the lowering position within 21 seconds after locating is permitted, the tonearm is stopped. If the lowering position is detected during this period, or if the tonearm is stopped forcibly for two seconds, the DD output is switched off, and the tonearm stopped. And if the tonearm leaves the address count area, manual mode is cancelled, and the tonearm returned.

Pin Functions

PIN NO	Symbol	I/O Display	Pin Name	Function	Remarks
1	R4	Out	Digit out	OPEN, CLOSE, REST, and UP SW scanning output  SCAN	
2	R5	Out	MUTE out	Muting ON/OFF output  ON OFF	
3	R6	Out	Band servo out	Band servo ON/OFF output  OFF ON	
4	R7	Out	START/STOP out	Phono motor start/stop output  STOP START	
5	R8	Out	33/45	Phono motor 33/45 switching output  33rpm 45rpm	
6	R9	Out	CLOSE out	Loading motor output (loading in operation)  ON OFF	
7	R10	Out	OPEN out	Ditto (loading out operation)  ON OFF	
8	R11	Out	Up out	Tonearm drive motor output (UP and rest operations)  ON OFF	
9	R12	Out	DOWN out	Ditto (outer edge and Down operations)  ON OFF	
10	R13	In	End area in	End detectable area input  End area	
11	R14	In	DD area in	Tonearm drive (DD/mechanism) area input  DD Mechanism	
12	K0	In	Address A in	Address sensor A phase input	
13	K1	In	Address B in	Address sensor B phase input	
14	K2	In	Zero-cross in	(Band sensor) inter-track center, registration start input  INPUT	
15	K3	In	Inter-track in	(Band sensor) inter-track input  Inter track	
16	Extal	—	—	Built-in clock oscillator, external connection pins	Ceramic resonator
17	Xtal	—	—	Ditto	f = 3.58MHz
18	Reset	—	—	CPU initialization reset inputs; reset by L, normally H	
19	IRQ		Manual SW in	Manual tonearm set/cut SW input  SW input	
20			(Not used)		
21	Vss	—	—	GND	
22			(Not used)		
23			(Not used)		
24			(Not used)		
25	O0	Out	Synchro out	Deck synchro output	
26	O1	Out	DD FST	Tonearm horizontal drive, speed switching output  SLOW FAST	
27	O2	Out	DD ◁	Tonearm horizontal drive output (inward direction)  OFF ◁	
28	O3	Out	DD ▷	Ditto (outward direction)  OFF ▷	
29	O4	Out	LED output	LED dynamic drive output  ON	
30	O5	Out	LED output	Ditto  ON	
31	O6	Out	LED output	Ditto  ON	
32	O7	Out	LED output	Ditto  ON	
33	P0	Out	Digit output	KEY matrix outputs  LED output  Key scan output	
34	P1	Out	Digit output	KEY matrix outputs  LED output  Key scan output	
35	P2	Out	Digit output	KEY matrix outputs  LED output  Key scan output	
36	P3	Out	Digit output	KEY matrix outputs  LED output  Key scan output	
37	R0	In	KEY input	KEY matrix inputs	
38	R1	In	KEY input	KEY matrix inputs	
39	R2	In	KEY input	KEY matrix inputs	
40	R3	In	KEY input	KEY matrix inputs	
41			(Not used)		
42	Vcc	—	—	+5V	

3.2.2 Programmed Play Mode

The following circuit description is for the case where the POWER switch (S6) is switched on, the **O/C** key S312 (OPEN/CLOSE switch) pressed to move the slide base out, a 30cm LP record placed on the turntable platter, and the turntable is programmed to play the 3rd and 1st tracks.

■ Programming

1. The turntable is programmed in the following way when tracks 3 and 1 are to be played in that order.
2. When the **3** key (PROGRAM SEARCH 3 switch) S303 is pressed, the **3** LED lights up (actually it turns off and then on again), indicating that the 3rd track has been programmed. Then when the **1** key (PROGRAM SEARCH 1 switch) S301 is pressed, the **1** LED lights up.

- If the wrong track is programmed by mistake, press the **STOP** key (STOP switch) S311 to clear the entire program. Recommence the programming from the beginning.
- Although programming of up to 14 tracks is possible, it is not possible to detect more than eight tracks on one side of the record.
- When the same track is selected repeatedly, the key number LED of the pressed key is turned off and then on again.

■ Auto Lead-in

1. When the **START** key (START switch) S310 is pressed, L level is applied to pin 38 of the system control IC (IC1), resulting in pin 8 being switched to L level. Since pin 34 of IC1 is at L level, switch S310 on switches pin 38 to L level via diode D306.
2. With pin 8 of IC1 at L level, pin 3 of the tonearm lead-in direction (clockwise) to commence auto lead-in operation.
3. The **START** LED (D319) is turned on at the same time. When S310 is switched on, pin 31 of IC1 is also set to L level, thereby switch D319 on. Transistor Q303 is for current drive purposes.
4. The tonearm continues the lead-in operation, and when the stylus approaches the center spindle, an H level signal from the DD area sensor (consisting of LED D203 and photo-sensitive transistor Q203) is applied to pin 11 of IC1. LED D203 activates the photo-sensitive transistor (that is Q203 is turned on), and the Q203 emitter voltage switches pins 1 and 2 of the waveform rectifier IC (IC202) to H level. This results in pin 3 also being switched to H level, followed by pin 11 of IC1 being switched to H level.

5. This change results in pins 26 and 28 of IC1 being made L level, thereby activating the tonearm DD drive circuit. The tonearm is consequently driven by the DD motor from this point.

- The tonearm drive motor drive mechanism releases the mechanical latch at this stage, and switches tonearm drive over to the DD motor.
1. The tonearm drive motor drive mechanism continues operating in the lead-in direction after being released, and switches the UP switch S4 off by the drive plate.
 2. An L level input is applied to pin 39 of IC1 when S4 is switched off, resulting in pin 8 being switched to H level and pin 9 to L level (with S4 switched off, pin 39 of IC1 is connected to pin 1 of the same IC via S4 and D7).
 3. This results in pin 2 of IC201 being switched to L level, and pin 3 to H level. The tonearm drive motor rotation direction is thus reversed (counter clockwise for lead-out operation).
 4. This reverse rotation results in the drive plate switching the UP switch S4 on again. Pins 8 and 9 of IC1 are switched to H level, and the tonearm drive motor is stopped. UP switch S4 remains on in standby status.

6. Tonearm lead-in is continued by DD motor drive, and the 110th pulse from address A sensor (consisting of LED D201 and photo-sensitive transistor Q201) is finally applied to pin 12 of IC1 (with the stylus near the lead-in groove of the 30cm record).
7. When the 110th pulse is applied to pin 12 of IC1, pin 27 is switched to L level and pin 28 to H level. (Pin 26 remains at L level).
8. The DD motor reverses, and the tonearm starts to move to the 3rd track. The **3** LED D311 commences blinking at the same time, and pin 4 of IC1 is switched to L level, resulting in the phono motor being started via Q1, and the turntable being rotated.

Pins 12 and 13 of the buffer amplifier IC (IC7) are switched to L level when pin 27 of this IC is switched to L. The base voltage of transistor Q7 is consequently dropped, resulting in the transistor being turned on. The collector potential is then increased, resulting in a voltage being applied to pin 10 of the analog switch IC (IC4) via resistor R31. With pin 26 of IC1 at L level, pin 12 of IC4

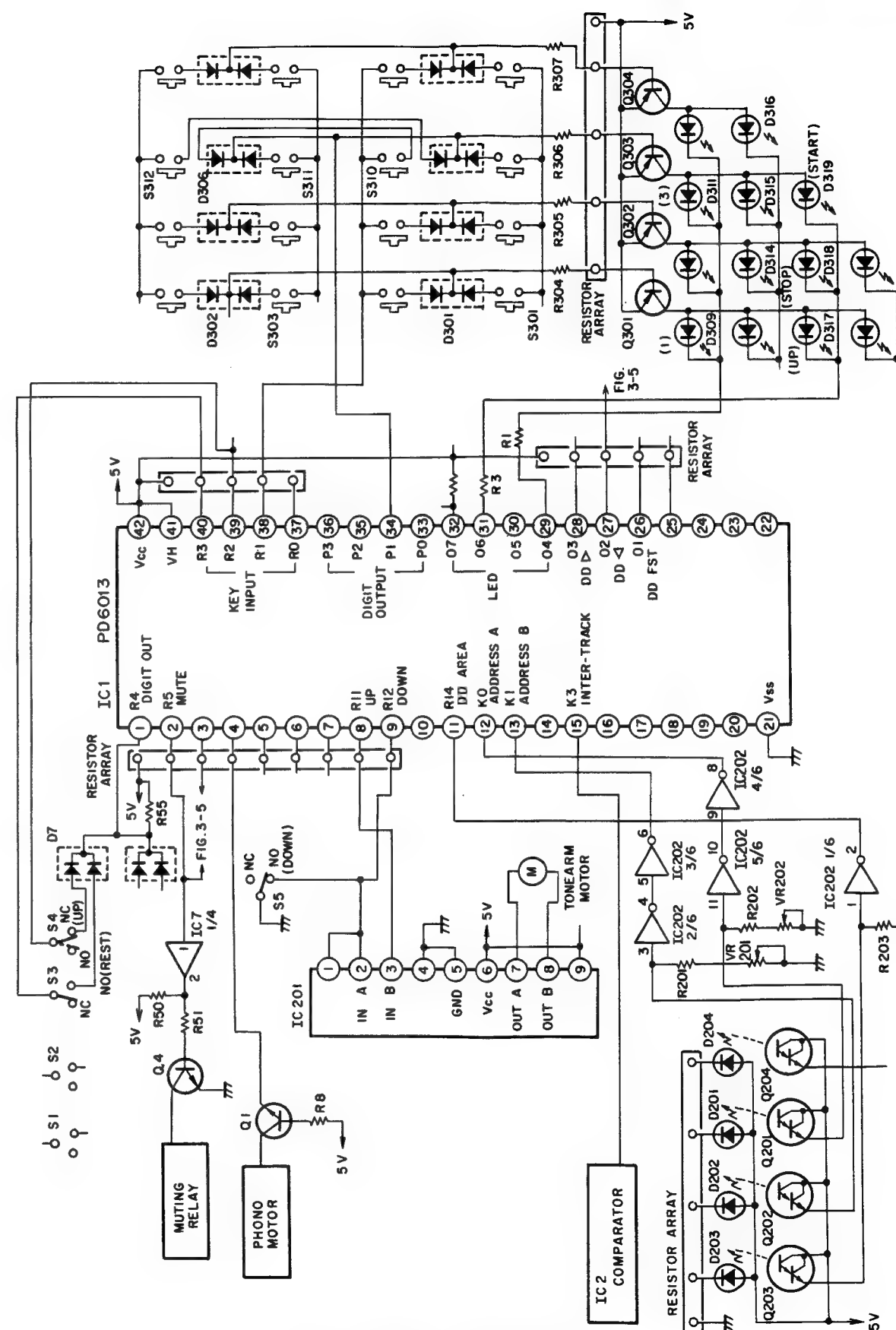


Fig. 3-3 Operation 1 (Programming)

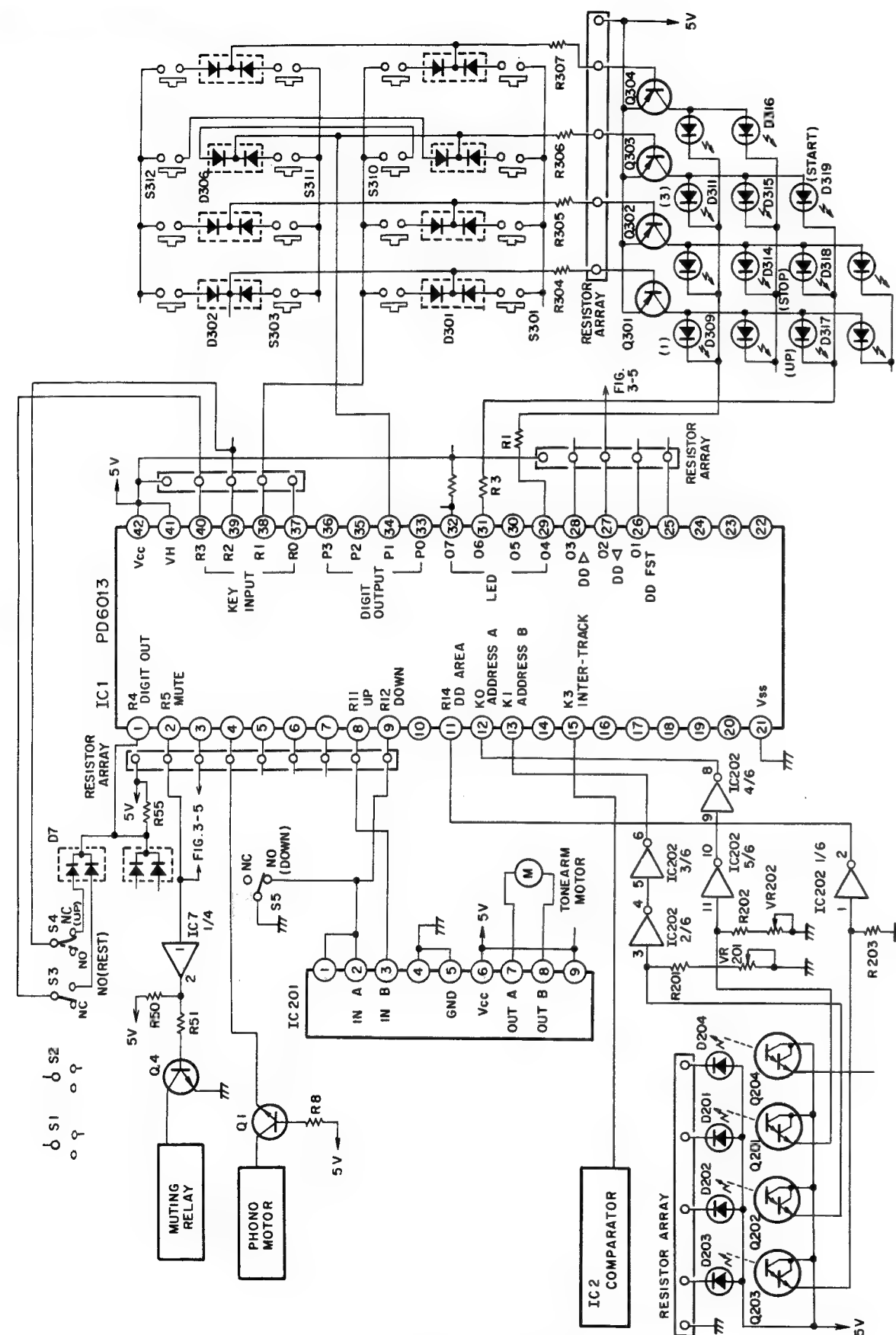


Fig. 3-4 Operation 2 (Programming)

is switched to H level due to +B (18V) being passed via resistor R35 (since transistor Q8 is off). And with pin 12 of IC4 at H level, the input applied to pin 10 appears at the output at pin 11 and is applied to pin 6 of the tonearm drive IC (IC5) (drive stage) as the differential amplifier (-) input. (Subsequent operations are described in section 3.4, "Drive Stage").

9. IC1 then stores (registers, via pin 11) addresses indicating what number pulses correspond to what tracks by passing pulses from the address A sensor via the waveform rectifier IC (IC202) from the time that tonearm drive is switched over to the DD motor. (See section 3.5 "Band Sensor Stage" for further details on address registration).
10. The signal from the address A sensor (LED D201 and photosensitive transistor Q201) is applied to pins 5 and 6 of IC202, the output appearing at pin 4 after waveform rectification. This output is then applied to pin 12 of IC1.
11. When the stylus is about 5mm away from the 3rd track (four addresses prior to the 3rd track registration address), pin 26 of IC1 is switched to H level. The tonearm is thus slowed down for start of search for the start of the 3rd track.

Transistor Q8 is turned on when pin 26 of IC1 is switched to H level. This results in pin 12 of the analog switching IC (IC4) being switched to L level, thereby cutting the pin 11 output. The input applied to pin 6 of the tonearm drive IC (IC5) (drive stage) forms a circuit connecting resistor R31 and R36 in series.

12. When the 3rd track signal from the band sensor (output from pin 13 of the comparator IC IC2) is applied to pin 15 of IC1, pin 27 of the same IC is switched to H level by the leading edge of that signal.
13. Q7 is turned off when pin 27 of IC1 is switched to H level, resulting in inhibition of input to pin 6 of IC5, and subsequent stopping of tonearm DD drive. The **START** LED D319 and **UP** LED D317 are both turned off.
14. At the same time, pin 8 of IC1 is switched to L level, and the drive mechanism waiting in Up standby is activated, resulting in start of tonearm DOWN operation.
15. Pin 3 of IC1 is also switched to L level at this time, resulting in transistor Q6 being turned off. When Q6 is turned off, the collector is

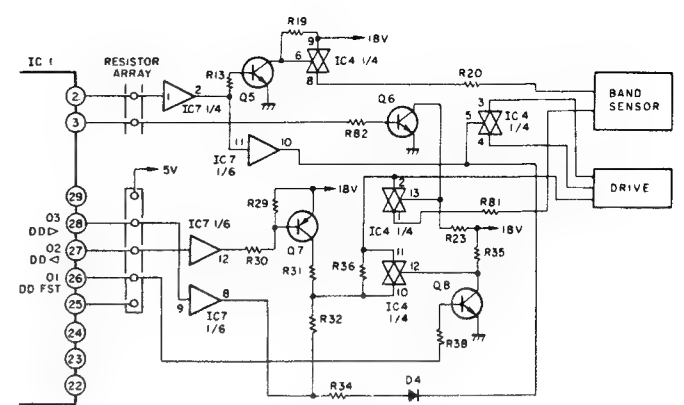


Fig. 3-5 Operation 3

- switched to H level (18V), resulting in pin 13 of the analog switching IC (IC4) also being switched to H level.
16. With pin 13 of IC4 at H level, pins 1 and 2 are both made conductive, and the band servo signal is applied to pin 6 of IC5 via resistor R81 (drive stage). (See section 3.5 "Band Sensor Stage" for details on the band servo signal). This results in cartridge stylus being controlled and moved down to the center of inter-track.
17. With the DOWN operation continued, the drive plate switches the DOWN switch S5 on, resulting in pin 2 of IC201 and pin 9 of IC1 being switched to L level. The tonearm drive motor is stopped and the tonearm DOWN operation completed.
18. At the same time, pin 3 of IC1 is returned to H level and Q6 is turned on, thereby switching the collector and pin 13 of IC4 to L level.
19. Pins 1 and 2 of IC4 are no longer conductive, and pins 1 and 2 of IC1 are switched to L level. Pin 2 of IC7 is also switched to L level. Q4 is turned off, the MUTING relay also turned off, and the turntable thus put into play mode.

- Transistor Q5 is turned off by pin 2 of IC7 being switched to L level, and the Q5 collector is switched to H level (18V) together with pin 6 of IC4. This makes pins 8 and 9 conductive, thereby switching band sensor sensitivity from UP mode sensitivity to PLAY mode sensitivity.
- The L level at pin 2 of IC7 also switches pin 10 of IC7 to L level, and with pin 5 of IC4 at L level, pins 3 and 4 of IC4 are made nonconductive. The signal applied to drive stage from the detector coil is thereby stopped, switching the speed servo off.

(See section 3.4 "Drive Stage" for further details on the speed servo).

- And with pin 10 of IC7 switched to L level, the voltage balance between the (—) pin (pin 6) and the (+) pin (pin 5) of the horizontal drive DD amplifier in the drive stage IC5 is upset slightly via R36, D4, and R34. This change serves as anti-skating quantity during play mode.

■ Next Track Lead-in

1. Approximately 2mm before the end of the 3rd track (that is, two addresses prior to the address registered for the 4th track), IC1 waits for input of zero-cross signals to pins 14 and 15. That is, the IC is in inter-track input standby mode.
2. An H level signal is then applied to pin 14 of the IC1, followed by an H level signal also being applied to pin 15. Next, an L level signal is applied to pin 15 and then to pin 14. According to this timing, IC1 discerns when the stylus reaches the inter-track area between the 3rd and 4th tracks.
3. When IC1 detects the end of the 3rd track, pin 2 is switched to H level, followed by pin 2 of IC7 also being switched to H level. Since Q4 is turned on, the MUTING relay is also switched on. Play mode is thus interrupted, and the ③ LED D311 is turned off.

The band sensor sensitivity is switched to UP mode sensitivity at the same time, and the speed servo is switched on (as was described earlier). The UP LED D317 is turned on.

4. Pin 8 of IC1, on the other hand, is switched to H level and pin 9 to L level. This changes pin 2 of IC201 to L level, and pin 3 to H level, thereby rotating the tonearm drive motor in the UP direction (counter clockwise).
5. The tonearm thus commences UP operation, and the ① LED D309 starts to blink on and off. The drive plate also starts to rotate, switching the DOWN switch S5 off.
6. The drive plate continues to rotate (tonearm drive motor continues to rotate) and the UP switch S4 is switched on. Pins 8 and 9 of IC1 and pins 2 and 3 of IC201 are all switched to H level, thereby stopping the tonearm drive motor to complete the UP operation.
7. Upon completion of the UP operation, the **START** LED D319 is turned on, and pins 26 and 28 of IC1 are switched to L level. The DD motor commences operation, and the

tonearm is moved towards the outer edge of the record (towards the 1st track).

8. The tonearm moves past the start of the 1st track (that is, the lowering position for 30cm records) to a position four addresses past the address registered for the 1st track (and over the edge of the record), resulting in pin 26 of IC1 being switched to H level, pin 27 to L level, and pin 28 to H level.
9. The DD motor is reversed, and the tonearm moves back towards the start of the 1st track at a slower speed. When the address registered for the 1st track is reached, the DD motor is switched off, and the DOWN operation is commenced. The **START** LED D319 and **UP** LED D317 are both turned off.
10. Upon completion of the DOWN operation, the MUTING relay is switched off, and the turntable is returned to normal play mode. (The next track lead-in operation description should be read after the description for play of the 3rd track).

■ Auto Return

1. When the end of the 1st track is approached, the end of track is detected in the same as described in steps 1 to 6 of "Next Track Lead-in" above, thereby resulting in start of UP operation. At the same time, the **UP** and **STOP** LEDs are turned on, and the ① LED turned off.
2. Completion of the UP operation marks the end of the entire program. Pin 8 of IC1 is switched to H level and pin 9 remains at L level. The tonearm drive motor continues to rotate in the lead-in direction (counter clockwise), and the tonearm moves towards the arm rest.
3. When the tonearm reaches the arm rest and the REST switch (S3) is switched on by the drive plate, pin 40 is switched to L level while pin 9 returns to H level, thereby stopping the tonearm drive motor. (When the REST switch (S3) is switched on, the L level at pin 1 of IC1 is connected via D7 and S3 to pin 40). The tonearm is put into arm rest stand by mode, and all operations cease.

The tonearm auto return operation is driven from start to finish by the tonearm drive motor. The DD motor is not involved at all.

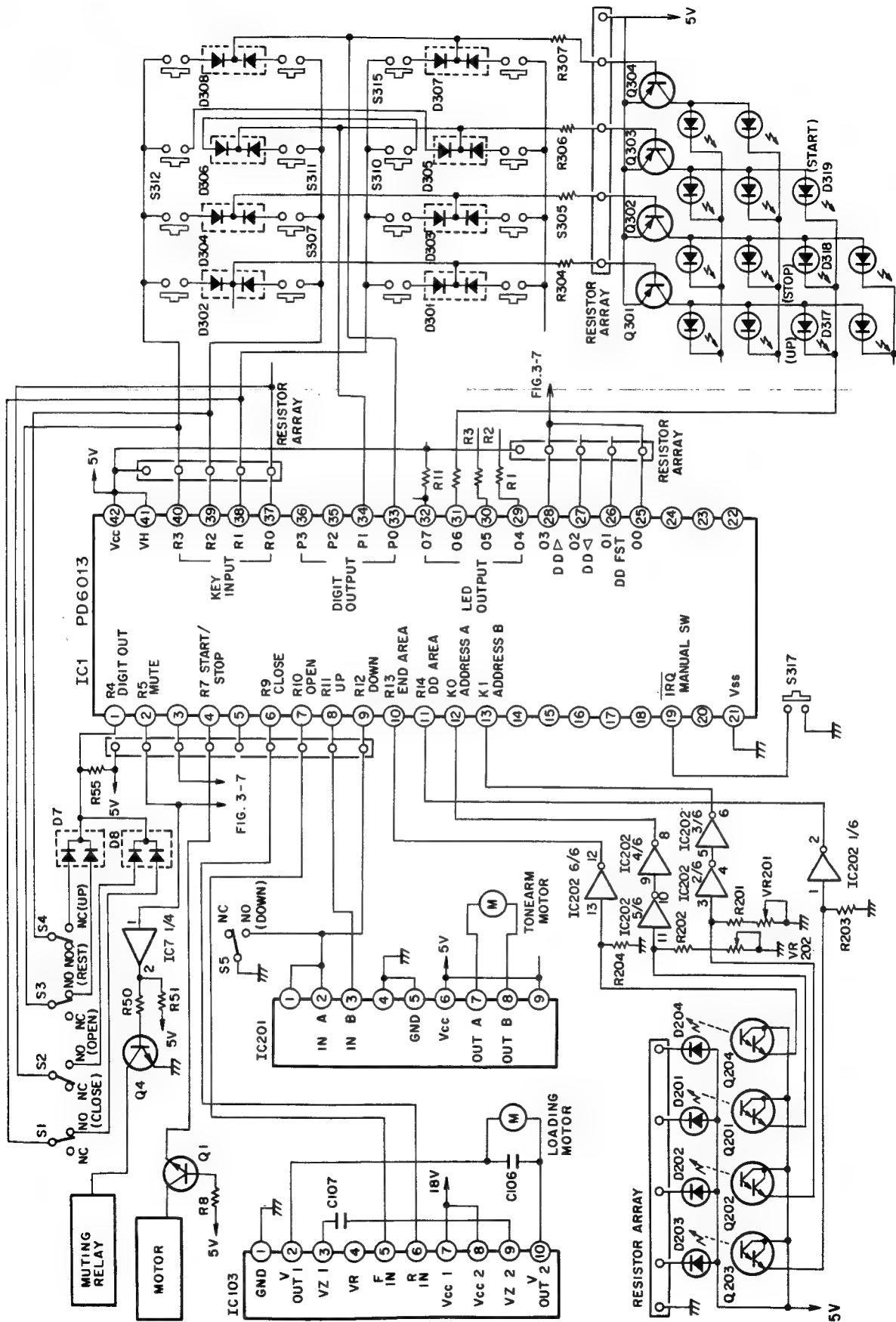


Fig. 3-6 Operation 4 (Manual 1 play)

3.2.3 Manual Play

■ Opening

1. When the **O/C** key (OPEN/CLOSE switch) S312 is pressed, pin 6 of IC1 is switched to L level.

Pressing of S312 connects the L level at pin 34 of IC1 to pin 40 via S312 and D305, resulting in an L level input being applied to pin 40, and an L level output appearing at pin 6.

2. With pin 6 of IC1 at L level, pin 6 of the motor drive IC (IC103) is also switched to L level resulting in the loading motor being rotated in the OPEN direction (clockwise). The slide base is thereby moved out, and the CLOSE switch S2 is switched off when struck by a projection on the slide base.
3. When the slide base is moved right out, the OPEN switch S1 is switched on. Pin 6 of IC1 is thus returned to H level, and the loading motor is stopped to complete the opening operation. With S1 on, the L level at pin 1 of IC1 is connected via S1 and D8 to pin 38. This leads to pin 6 then being switched to H level, followed by pin 6 of IC103 also being switched to H.

If OPEN switch S1 is not switched on within about 25 seconds after the start of the opening operation, the slide base drive operation is suspended, and the **START** LED D319 and **STOP** LED D318 begin to blink on and off to indicate that the slide base drive operation has not been properly completed.

■ Manual Lead-in

1. When the **M. A. S/C** key (MANUAL ARM SET/CUT switch) S317 is pressed, pin 19 of IC1 is switched to L level. This results in both pins 4 and 8 being switched to L level as well.

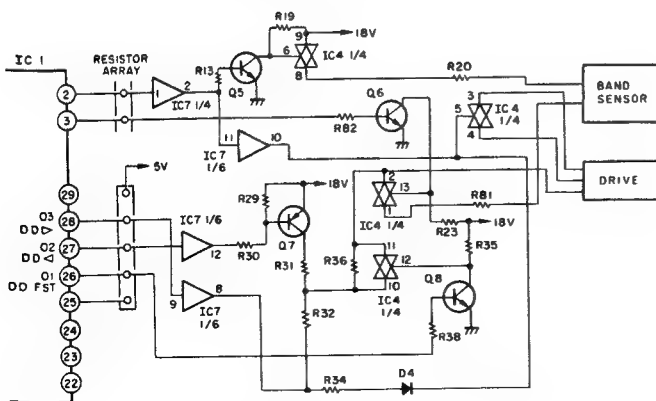


Fig. 3-7 Operation 5

2. With pin 8 of IC1 at L level, pin 3 of IC201 is also switched to L level, thereby starting up the tonearm drive motor in the lead-in operation direction to commence tonearm lead-in operation.
3. But since pin 4 of IC1 is also at L level, transistor Q1 is switched on due to the drop in emitter voltage. The motor control ass'y is consequently started up, resulting in rotation of the phono motor.
4. Subsequent tonearm lead-in operations are the same as for auto lead-in operations during programmed play mode.
5. Pin 26 of IC1 is reverted to H level when the trailing edge of the 103rd pulse from the address A sensor is applied to pin 12 of IC1 (corresponding to the stylus reaching the lead-in groove of a 30cm record). Tonearm movement is switched to slow speed as a result.
6. The tonearm continues the lead-in operation at the slower speed, and when the trailing edge of the 105th pulse from the address A sensor is applied to pin 12 of IC1, pin 28 of that IC is returned to H level, and the DD motor (horizontal drive) is switched off. The tonearm remains in the UP position (in manual play standby mode).
7. When the **EV** key (ARM ELEVATION switch) S315 is then pressed, pin 8 of IC1 is switched to L level. The tonearm drive motor is rotated, and the tonearm commences to lower onto the record (DOWN operation). Since the L level at pin 33 of IC1 is connected to pin 38 via D307 and S315 when this switch is on, pin 38 is also switched to L level, resulting in pin 8 being switched to L level as well. The **UP** LED D317 is turned off at this time.
8. When the DOWN operation is completed after switching the DOWN switch S5 on, pin 9 of IC1 and pin 2 of IC201 are switched to L level, and the tonearm drive motor is stopped.
9. Pin 2 of IC1 is switched to H level at the same time (with pins 1 and 2 of IC7 at L level), Q4 is switched on and Muting relay off, thereby putting the turntable into play mode.

■ Locate-in

1. When the **START** key (START switch) S310 is kept depressed during play mode, the tonearm switches over to locate-in operation mode.
2. Pressing of S310 connects the L level at pin 38 of IC1 to pin 9. Since pin 8 is at H level, pin 2 of IC201 is switched to L level and pin 3 to L level, resulting in the tonearm drive motor being rotated in the UP operation direction to commence elevation of the

tonearm.

3. Pin 2 of IC1 is also switched to H level, and with pins 1 and 2 of IC7 at H level, Q4 is switched on and the MUTING relay is activated, thereby interrupting play mode.
4. After the tonearm has been fully elevated following switching of the UP switch S4 on, pin 9 of IC1 and pin 2 of IC201 are returned to H level. The tonearm drive motor is thereby stopped with the tonearm left in the UP position.
5. If pressing of S310 is continued in this condition, pin 27 of IC1 is switched to L level and the DD motor commences to rotate. The tonearm starts moving at a slow speed towards the center in locate operation mode.
6. The [START] LED D319 continues to blink on and off while the [START] key remains pressed after locate operation has commenced.
7. When the [START] key is released at the desired position, pin 27 of IC1 is reverted to H level, the DD motor is switched off, and the tonearm stops moving in the UP position. The [START] LED D319 also stops blinking.
8. If the [EV] key (ARM ELEVATION switch) S315 is then pressed, the tonearm commences to lower onto the record in DOWN operation mode (see Manual Lead-in operation), thereby putting the turntable into play mode again.

- If the [START] key S310 is pressed continuously until the tonearm moves towards the center and the stylus reaches the spindle vicinity, the H level signal from the DD area sensor at pin 11 of IC1 is switched to an L level signal. Consequently, pin 8 of IC1 and pin 3 of IC201 are switched to H level while pin 9 of IC1 and pin 2 of IC201 are switched to L level.

The tonearm drive motor starts to rotate in the direction for return to the arm rest, resulting in tonearm drive being switched back from DD motor drive to tonearm motor drive for automatic return to the arm rest.

- If the [STOP] key (STOP switch) S311 is pressed continuously, pin 28 of IC1 is switched to L level following completion of the UP operation. The tonearm is then moved slowly towards the lead-in groove at the outer edge of the record (locate-out operation).

■ Manual Auto Return

1. When the stylus approaches the lead-out groove (that is, reaches a position 62.5mm from the

spindle) during play mode, an L level signal from the end area sensor is applied to pin 10 of IC1, thereby activating the end detector function operated by the address A sensor (pin 12 of IC1) and address B sensor (pin 13 of IC1).

2. When the stylus enters the lead-out groove following end of play, the address A and B sensor output pulses become narrower in width. In this way, IC1 detects the end of record play.
3. Once the end of play has been detected, pin 8 of IC1 and pin 3 of IC201 are switched to H level while pin 9 of IC1 and pin 2 of IC201 are switched to L level, resulting in the tonearm commencing UP operation. The [UP] LED D317 is turned on at this time and the MUTING switch is switched on, thereby suspending play mode.
4. When the UP switch S4 is switched on and the tonearm completes the UP operation, the logic status of pins 8 and 9 is maintained, and the tonearm commences to move towards the arm rest.
5. When the tonearm reaches the arm rest and switches the REST switch S3 on, pin 9 of IC1 is reverted to H level (rest delay) and the tonearm drive motor is stopped, thereby completing the auto return operation. Pin 4 of IC1 is also switched to H level at this time, resulting in Q1 being turned off and the phono motor being stopped.

■ Closing

1. When the [O/C] key (OPEN/CLOSE switch) S312 is pressed while the slide base is extended, pin 7 of IC1 and pin 5 of IC103 are switched to L level, resulting in the loading drive motor being rotated in the CLOSE operation direction (clockwise) to return the slide base to its normal inserted position. When S312 is switched on, pin 40 of IC1 is connected to pin 34 via D305 and S312, resulting in pin 40 also being changed to L level. This is followed by pin 7 of IC1 becoming L level too.
2. After the slide base is reinserted into the turntable and the CLOSE switch S1 is switched on by that slide base, pin 30 of IC1 is connected to pin 1 via D8 and S1, resulting in pin 30 being switched to L level. Pin 7 is consequently reverted to H level, followed by pin 5 of IC103 also being switched to H level, resulting in the loading drive motor being stopped to bring all turntable operations to a halt.

3.3 Address Sensor Stage

The address sensor stage consists of LEDs D201, D202, D203, and D204 and the corresponding photosensitive transistors Q201, Q202, Q203, and Q204. The sensor output signals from each pair are passed to IC1.

Note that in addition to waveform rectification, IC202 (MB84069B) also serves as an inverter.

The circuit diagram and relevant timing chart are outlined in Fig. 3-8.

■ Sensor Roles

1. End area sensor

If the tonearm stylus moves to within less than R62.5mm from the center spindle during programmed play, normal full auto play, or manual play mode, the sensor output level is changed from L to H, the result being applied to pin 10 of IC1, thereby enabling end detection by the address A sensor (input applied to pin 12 of IC1) and address B sensor (input applied to pin 13 of IC1).

2. Address A and B sensors

● Address A sensor

(a) Address registration

This sensor generates output pulse signals at pin 12 of IC1 during turntable operation (that is, when the stylus is anywhere between the outer edge of a 30cm record and a position near the center spindle).

These pulses are formed by a slotted fan-shaped shutter moving together with the tonearm between LEDs and photosensitive transistors.

IC1 (pin 12) stores these pulse signals in memory as addresses 1 thru 110 starting from near the center spindle going up to the outer edge of a 30cm record.

(b) Tonearm movement direction detection

The direction of tonearm movement is detected by the address A sensor in combination with the address B sensor.

* Tonearm lead-out

The phase of address B sensor output pulses are ahead of address A sensor output pulses by 90° .

* Tonearm lead-in

The phase of address A sensor output pulses are ahead of address B sensor output pulses by 90° .

3. End detector

● Address B sensor

(a) Address registration

Although output pulse signals are generated at pin 13 of IC1 in the same way as for address A sensor, these signals are not registered as addresses.

(b) Tonearm movement direction detection

(c) End detection.

■ DD Area Sensor

When the tonearm stylus approaches the center spindle, the L level is switched to H level. When this change is received by pin 11 of IC1 for auto lead-in, tonearm drive is switched from the tonearm drive motor to the horizontal DD drive motor.

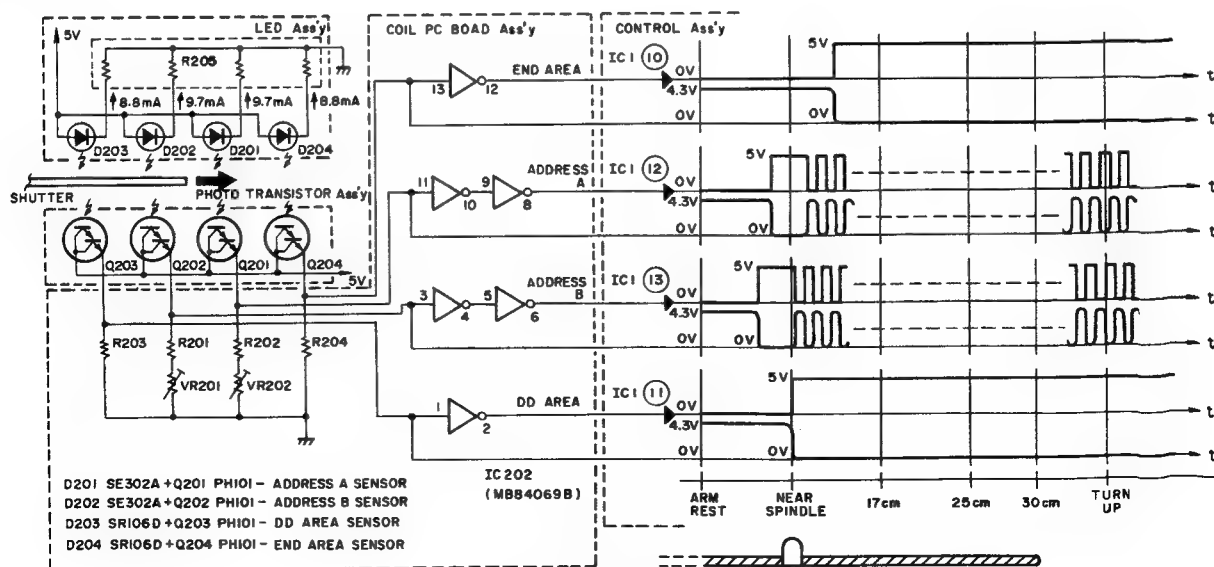


Fig. 3-8 Timing chart

3.4 Drive Stage

The drive stage consists of drive coil formed by two coils connected in series, a horizontal drive circuit for passing a current through the drive coil, a detector coil, and an amplifier for amplifying the faint voltages generated in the detector coil.

The circuit diagram is outlined in Fig. 3-9.

■ Horizontal Drive Circuit

The horizontal drive circuit incorporates the tonearm drive amplifier IC (IC5) NJM4556D. This IC consists of a differential amplifier and an inverter (gain 1).

As can be seen in Fig. 3-9, the band servo signal from the band sensor is applied to the (−) input of the differential amplifier, and the speed servo signal from the detector coil is applied to the (+) input. The differences between these signals and their corresponding reference voltages are amplified and passed through respective drive coils to move the tonearm secured to a moving magnet.

- The band servo and speed servo signals applied to the (−) input of the differential amplifier are controlled by the analog switching IC (IC4) MB84066B which in turn is switched on and off by control signals from the control stage.
- The operation control signals (start, stop, locate, and programmed play) from the control stage are activated by applying (+) or (−) signals (in respect to a reference voltage) to the (−) input of the differential amplifier.

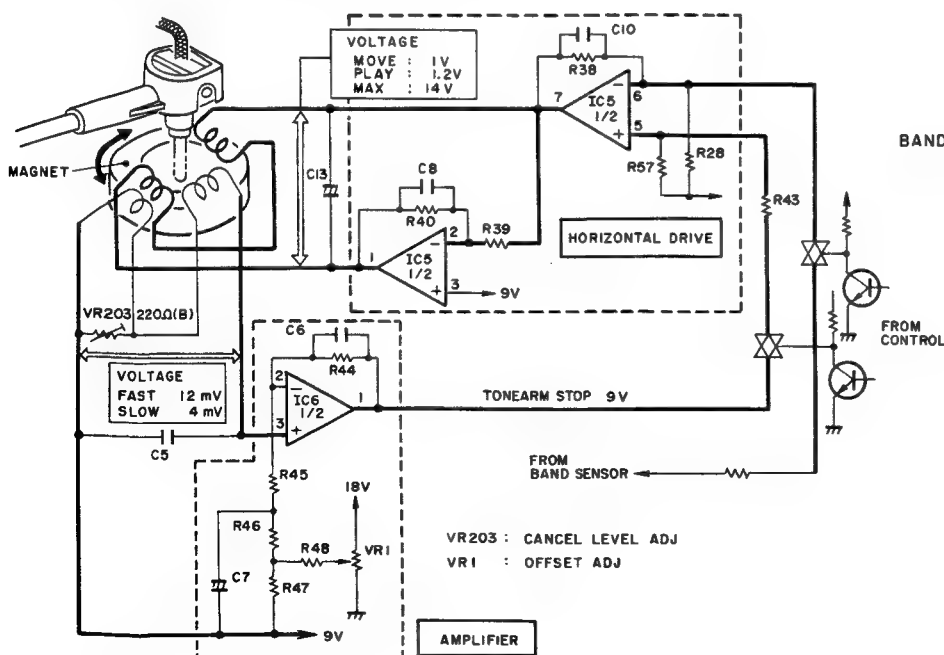


Fig. 3-9 Drive stage

1. Amplifier circuit

The amplifier circuit consists of a tonearm speed detector IC (IC6) NJM4558D, a horizontal DD offset adjustment control VR1, and a horizontal DD cancel control VR203.

- IC6 is a differential amplifier designed to amplify the faint voltages generated in the detector coil in accordance to the tonearm rotational speed, the output signals being applied as speed servo signals to the (+) input of the horizontal drive circuit differential amplifier.

■ Band Servo Operation

The characteristics of the band sensor output in respect to inter-track sections on the record are outlined in Fig. 3-10.

If the stylus moves outwards from the center of an inter-track section by Xmm, a band sensor output AV is generated. As a result of this output, a current is passed through the drive coil via the horizontal drive circuit. The activated coil consequently moves the stylus back to the center of the inter-track section. Hence, this servo mechanism keeps the stylus positioned constantly at the center.

This band servo operation is started at the same time that the EV DOWN operation is started after the stylus is brought to above the inter-track section during programmed play mode. The servo operation is then completed at the same time that the DOWN operation is completed.

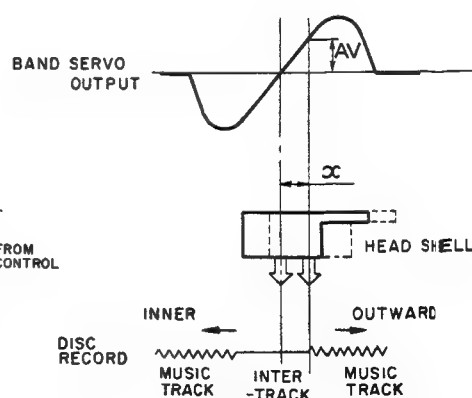


Fig. 3-10 Band servo

3.5 Band Sensor Stage

The band sensor stage consists of a double eye sensor (band sensor), an amplifier circuit, a differential amplifier, an AC amplifier, an inter-track comparator, and a zero-cross comparator.

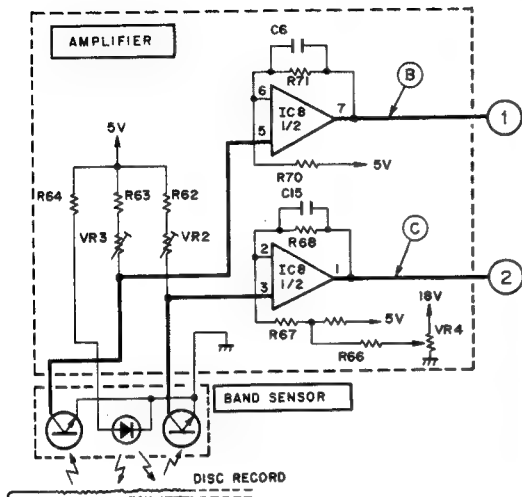


Fig. 3-11 Band servo 1

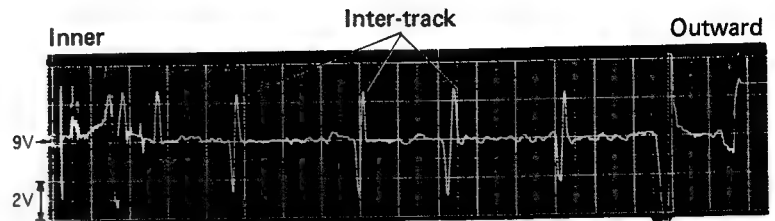


Fig. 3-13 Output waveform A

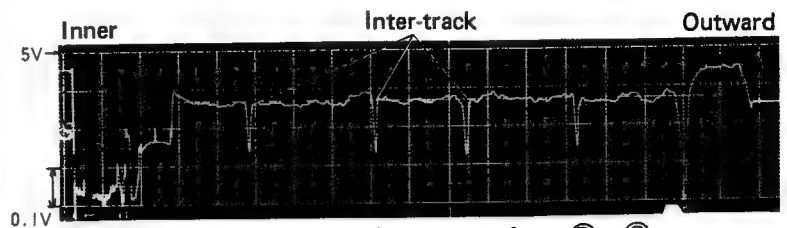


Fig. 3-14 Output waveform B, C

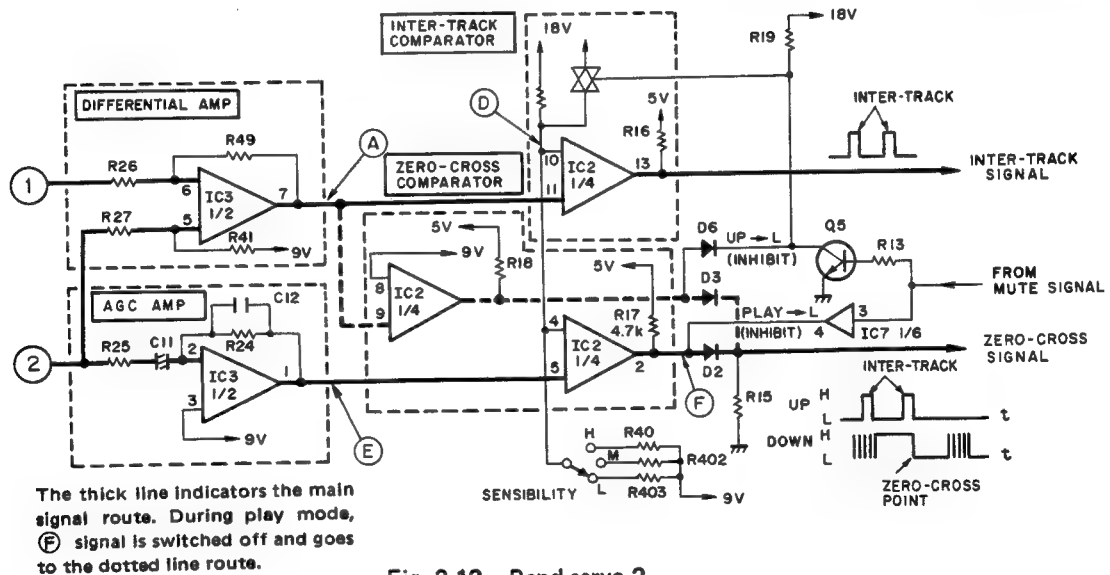


Fig. 3-12 Band servo 2

■ Band Sensor

This sensor consists of two photosensitive transistor arrays and infrared LEDs NJL1102EH incorporated in the tip of the head shell.

By utilizing the differences in the amount of reflected light beamed onto the sound tracks and inter-track areas of a record, this sensor is capable of detecting the boundary between the two areas.

■ Amplifier Circuit

This circuit consists of an inter-track signal amplifier IC (IC8) NJM072D plus band sensor gain adjustment controls VR2 and VR3. The circuit amplifies the band sensor output, the output waveform being shown in Fig. 3-14.

■ Differential Amplifier

Utilizing inter-track signal amplifier IC (IC3) NJM4558D1/2, two band sensor outputs are amplified differentially to obtain the output waveforms shown in Fig. 3-13.

■ AC amplifier

This circuit also employs the inter-track signal amplifier IC (IC3) NJM4558D1/2, amplifying the AC component (DC cut) of the amplifier circuit at point (C) to obtain an output for the zero-cross comparator.

■ Zero-cross Comparator

Utilizes half of the comparator IC (IC2) NJM-2901N.

- Upon reception of the signal from the AC amplifier during UP operation mode, the signal obtained by cutting the voltage at point (D) is passed as the inter-track registration enable signal to pin 13 of IC1.
- Detection of the zero-cross point of the signal from the differential amplifier during DOWN operation (during record play). The zero-cross and inter-track signals are processed by IC1 for detection of the inter-track center during tracing.

3. 6 POWER SUPPLY STAGE

■ Current Levels Employed during Each Mode

[mA]

Mode	I ₀₀	I ₀₁
When all operation has stopped	180	245
Play	180	210
Loading	255	245
Loading lock	395	245
Phono motor lock	415~480	245
Lead-in return (horizontal DD)	180	255
Lead-in return (mechanism motor)	180	255
Lead-in return lock (horizontal DD)	180	340
Lead-in return lock (mechanism motor)	180	340
Phono motor loading and simultaneous lock	740	250

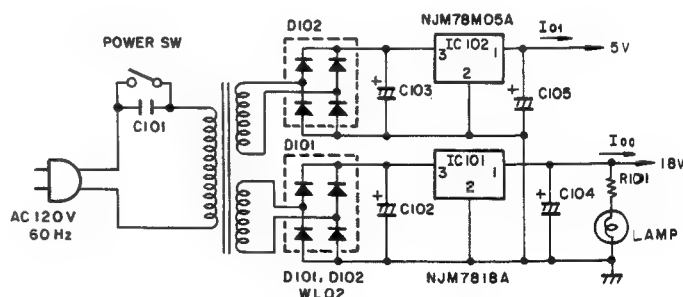


Fig. 3-15

3.7 Rotation Motor Stopping Circuit (Only on KU type)

If movement of the slide base is obstructed by an object or other source after it has begun moving in or out, the stopping circuit described below functions to halt movement of the slide base.

1. Movement of the slide base is controlled by the loading motor.
2. If movement of the slide base is obstructed after it has begun to move, the current I_m going to the loading motor will increase (Fig. 3-17).
3. When I_m exceeds the threshold level of Q101, Q101 turns on, Q102 turns off and C109 is charged as 5 volts goes from R106 to R107 to C109 (about one second).
4. After about one second, Q9 turns on, pin 18 of IC1 goes to L and IC1 goes to the reset status.
5. As a result, the rotations of the loading motor halt and the slide base stops moving.
6. To cancel this status, perform the following steps:
 - * Remove the obstruction.
 - * If the slide base stopped on the way out, press the OPEN/CLOSE switch.
 - * If the slide base stopped on the way in, turn off the power switch and turn it back on again.

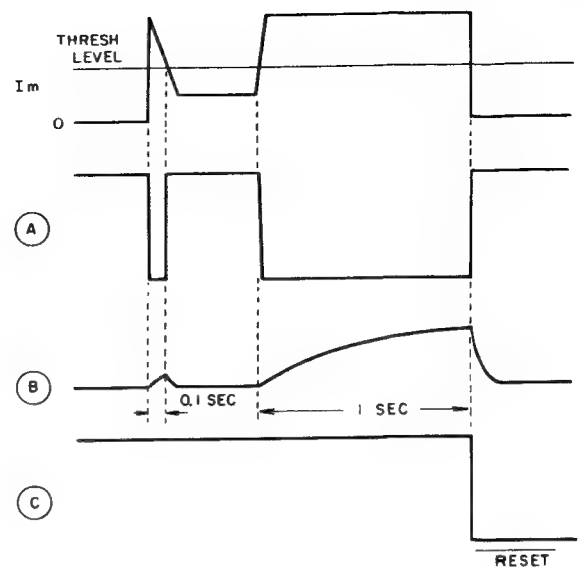


Fig. 3-16

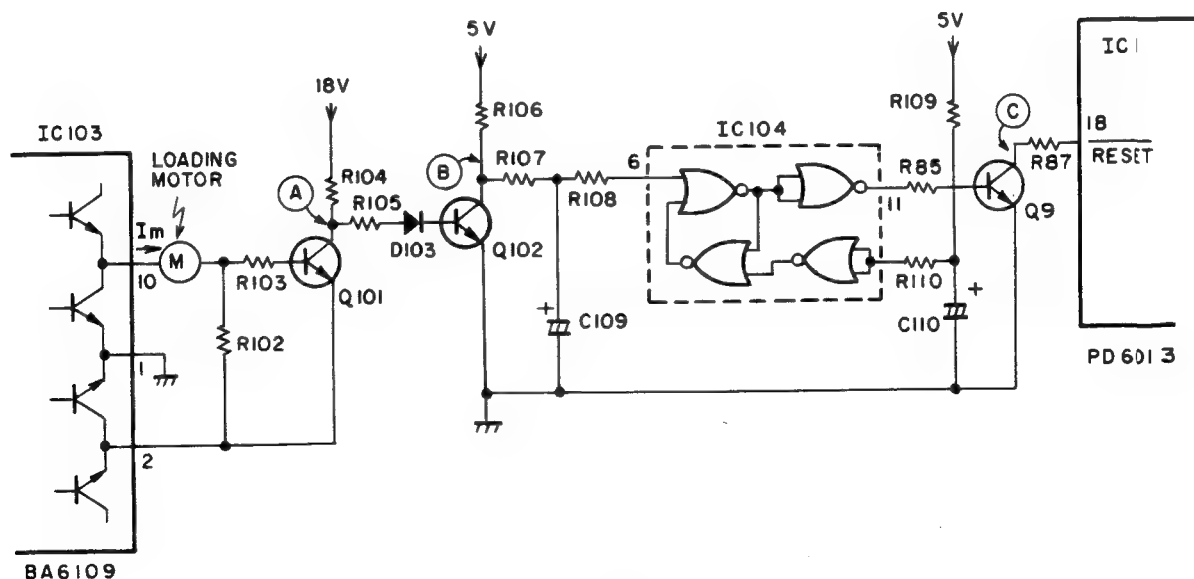
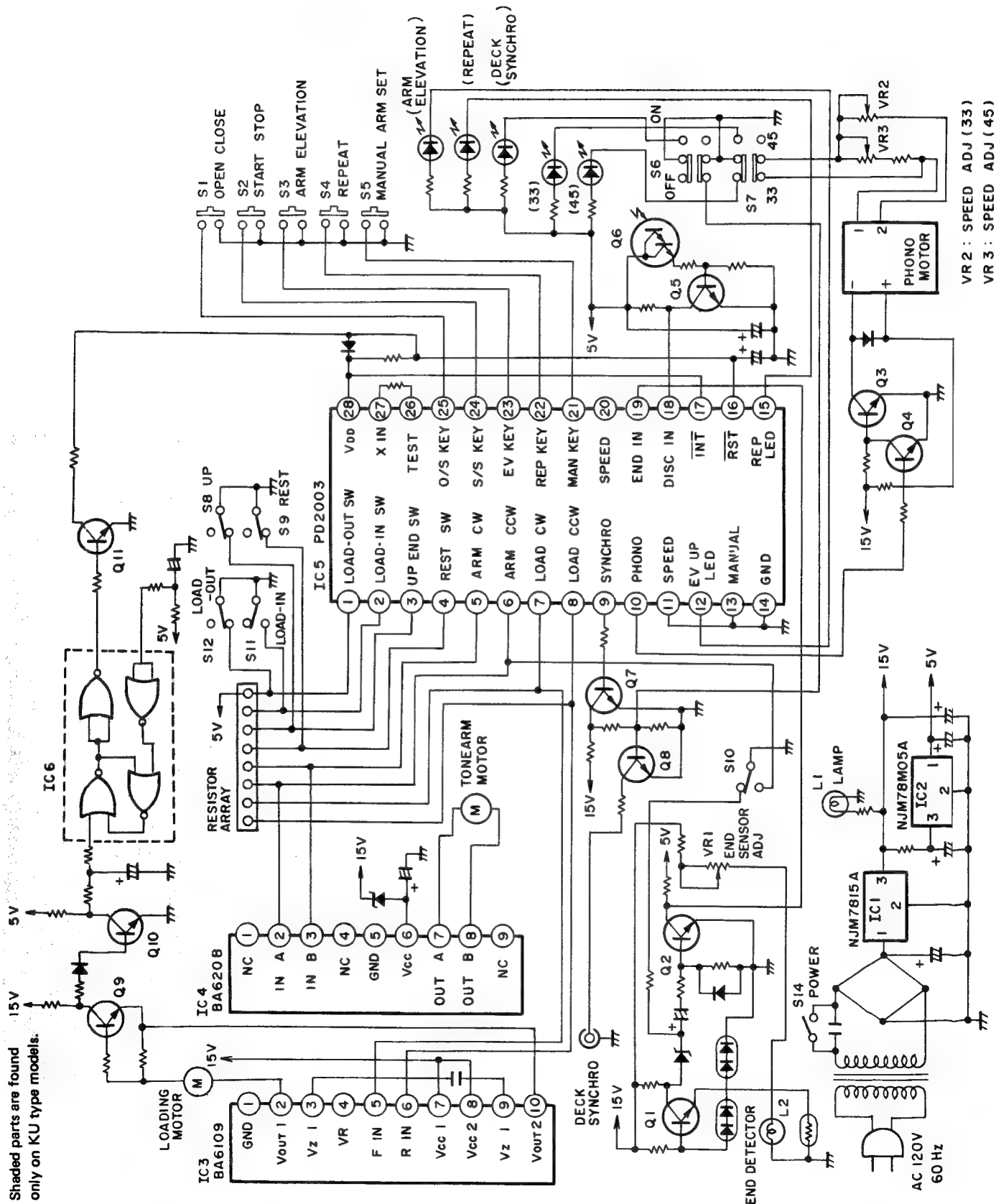


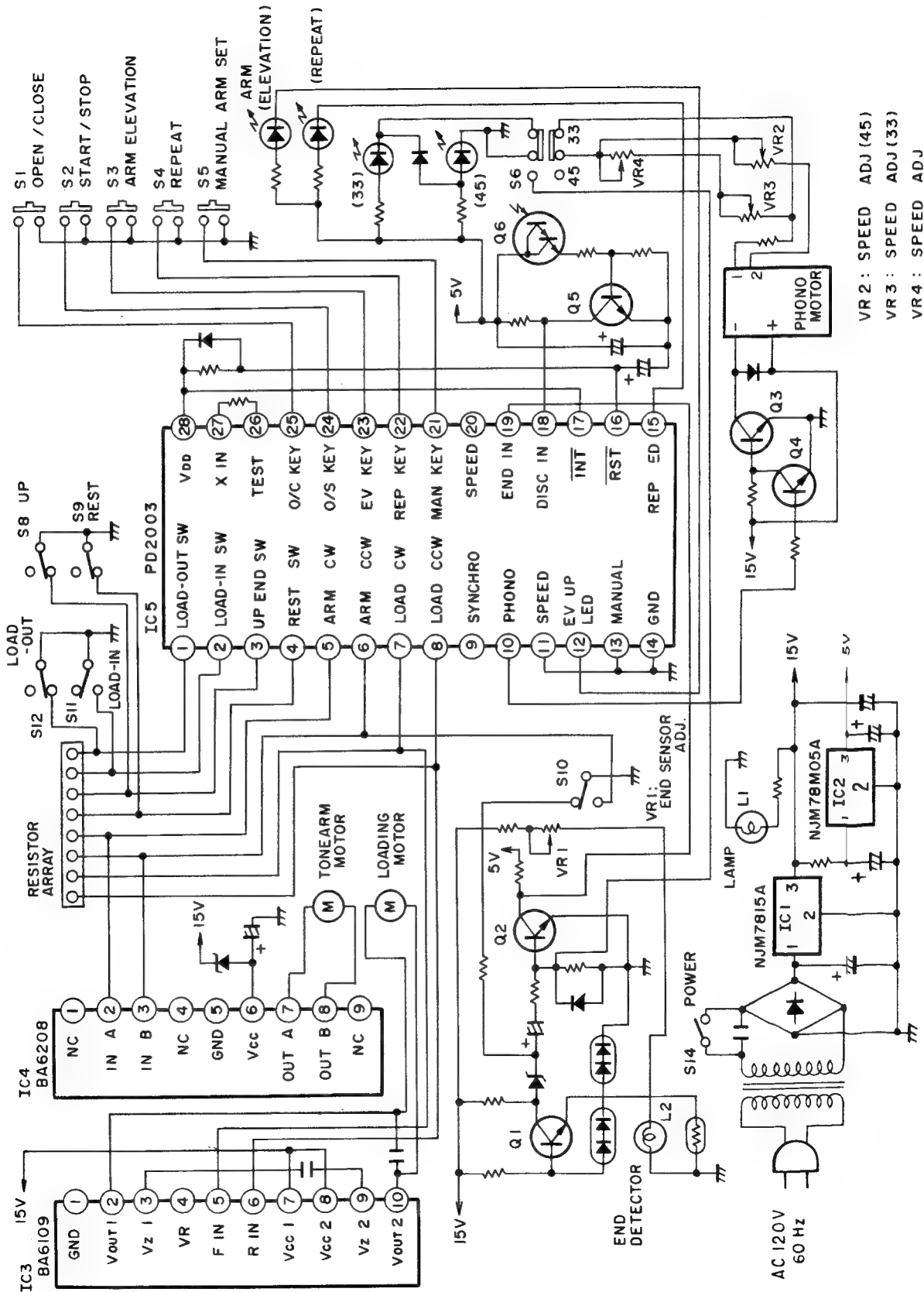
Fig. 3-17

4. CIRCUIT DESCRIPTION(PL-44F, PL-05)

■ BLOCK DIAGRAM (PL-44F)

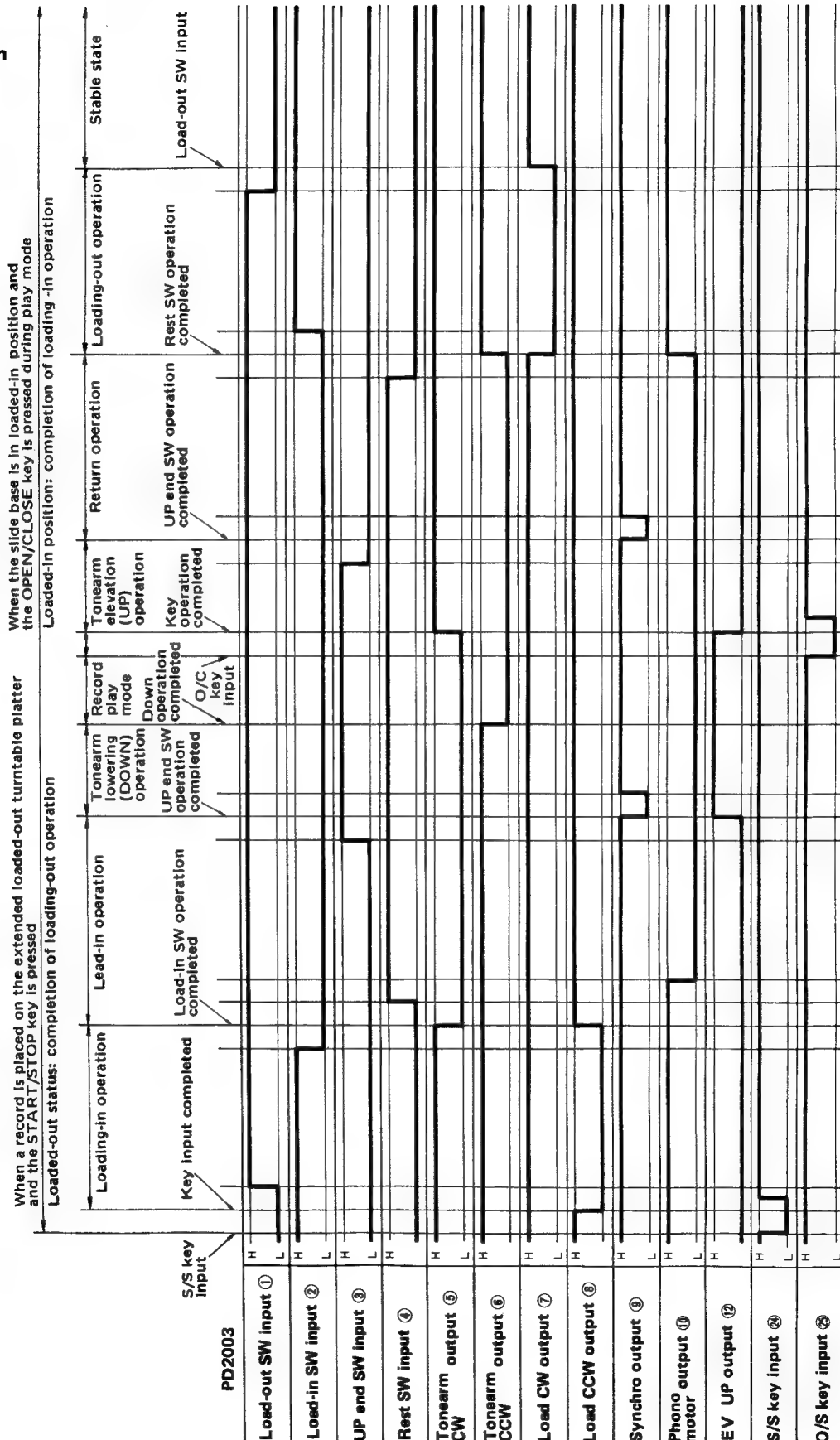


■ BLOCK DIAGRAM (PL-05)

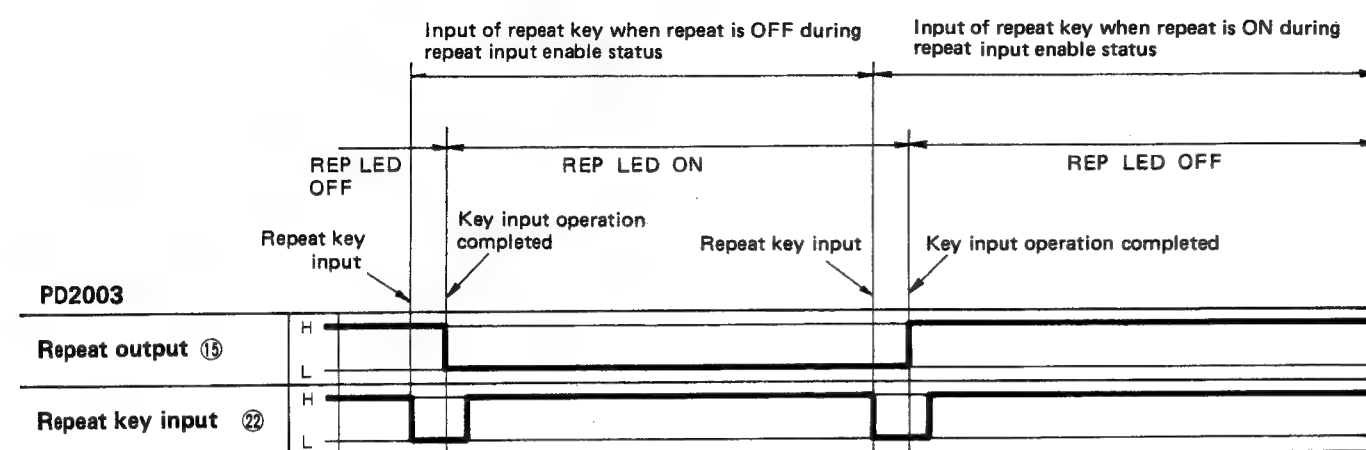


■ Timing Charts

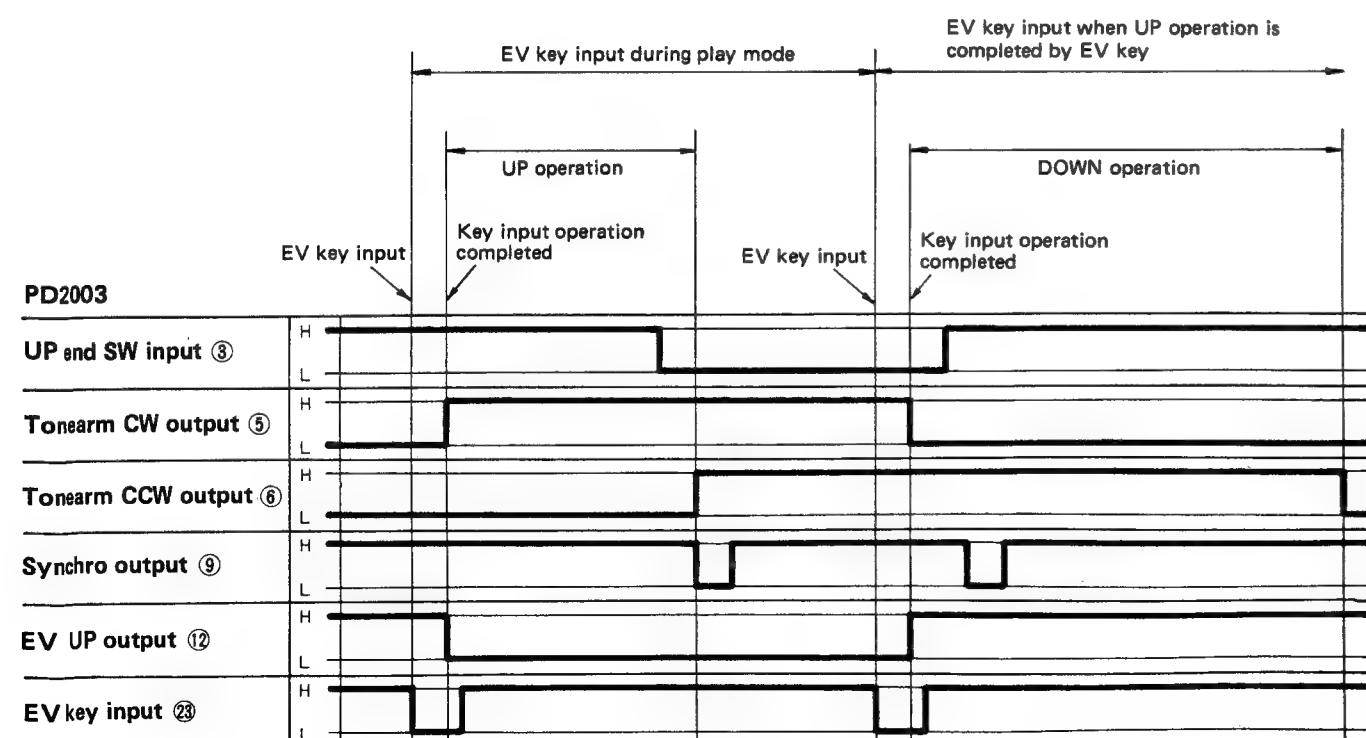
● Normal operation



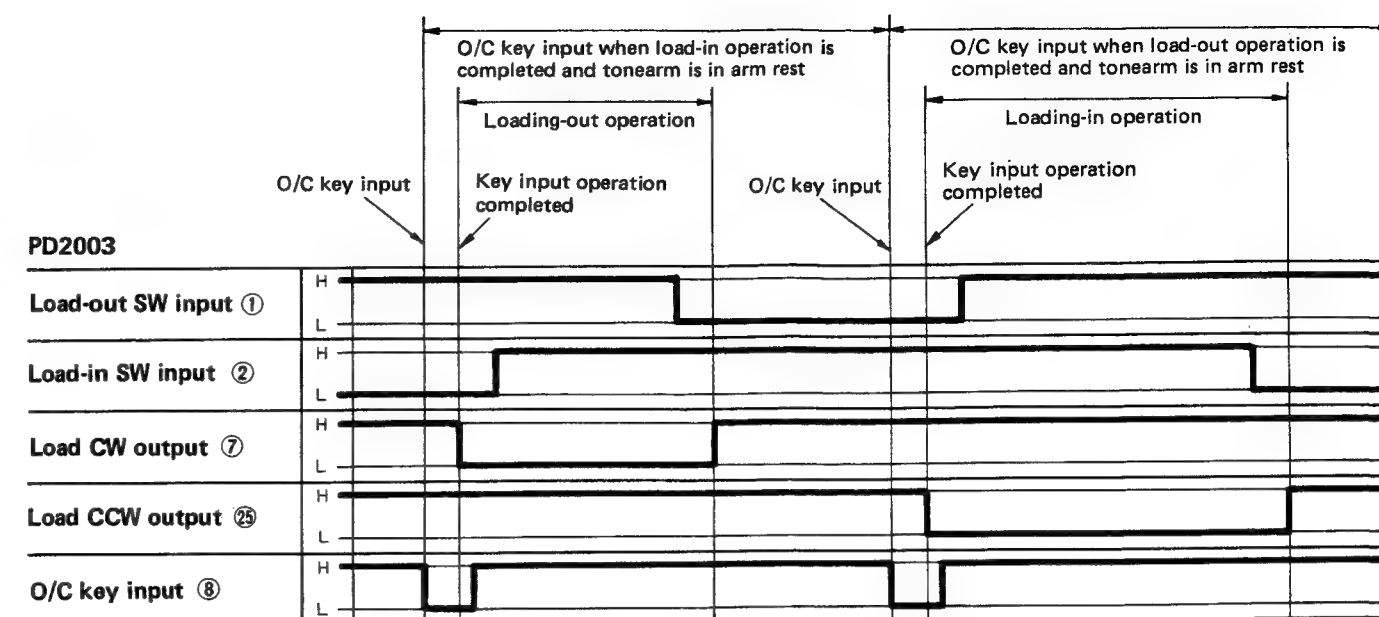
● Repeat ON/OFF



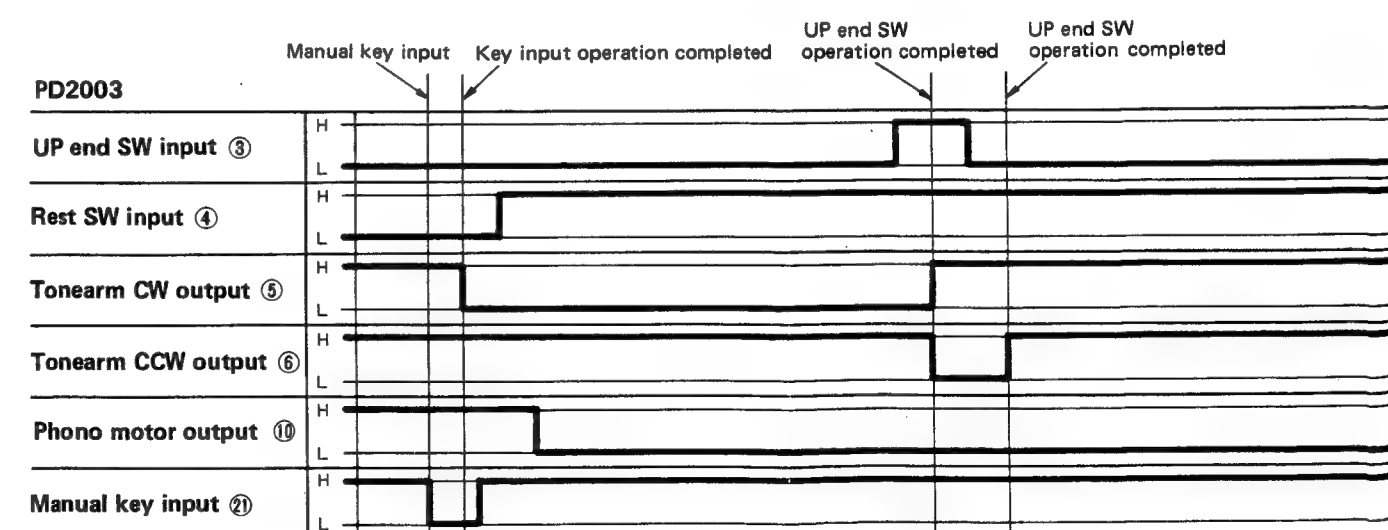
● Elevation UP/DOWN



● OPEN/CLOSE

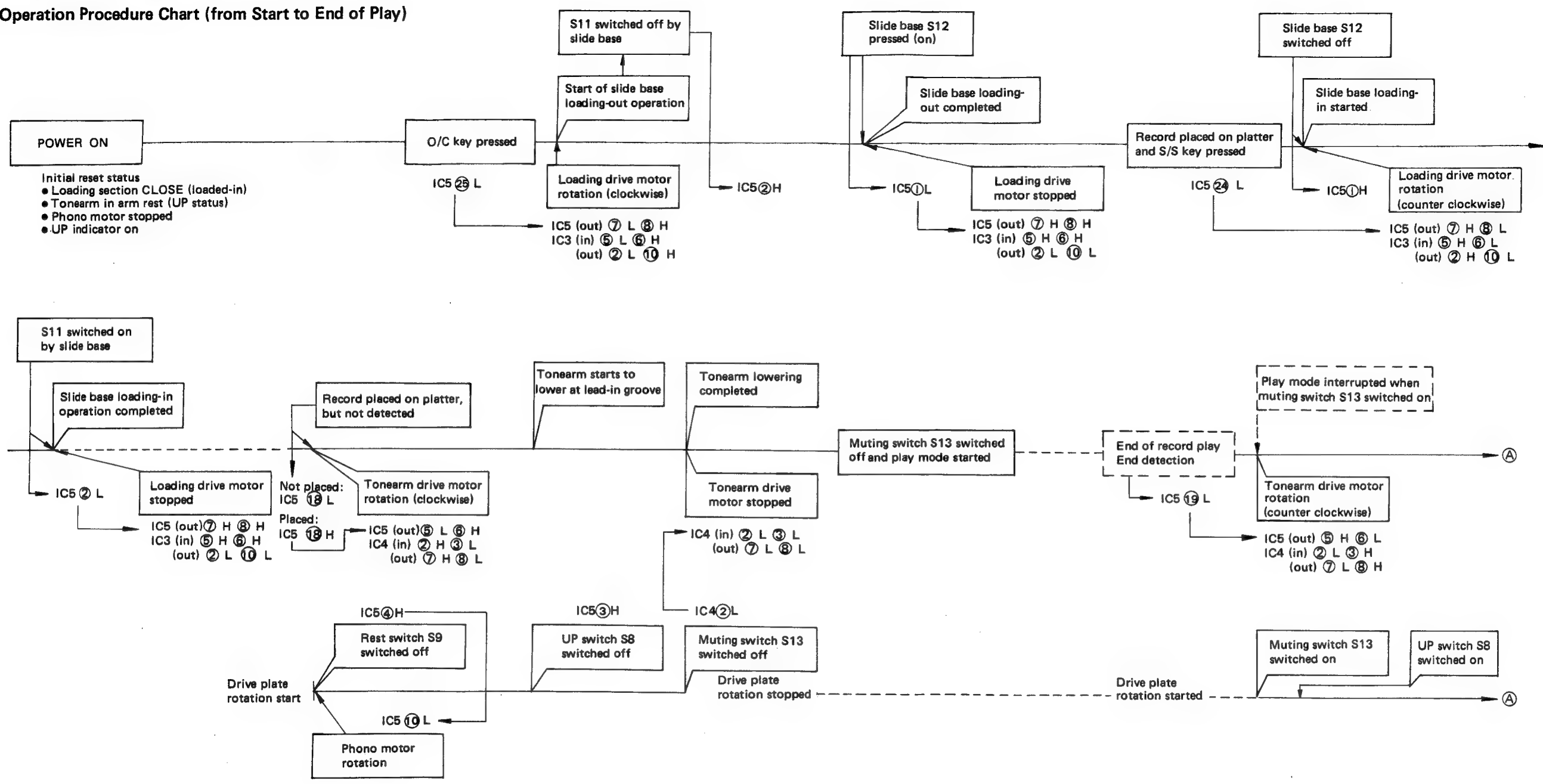


● Manual Lead-in

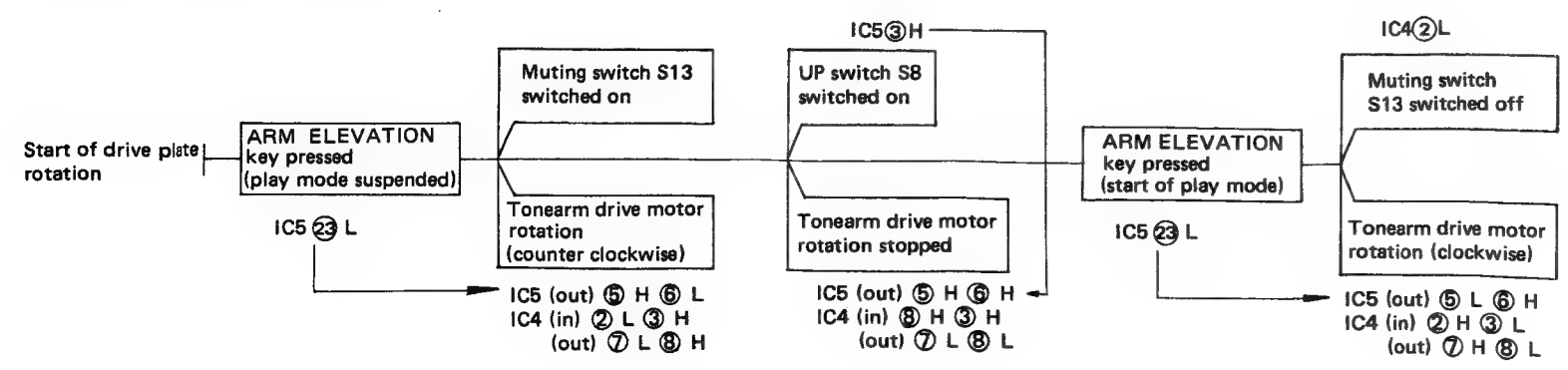


* When manual key is pressed after loading-out operation is completed and tonearm is in the arm rest.

■ Operation Procedure Chart (from Start to End of Play)



Tonearm Elevation Operation



Note:
● Steps after point ① occur in the reverse order to the steps performed up to this point.
● Tonearm elevation is performed during play mode.
● Repeat operation and other play interruption modes have been omitted.

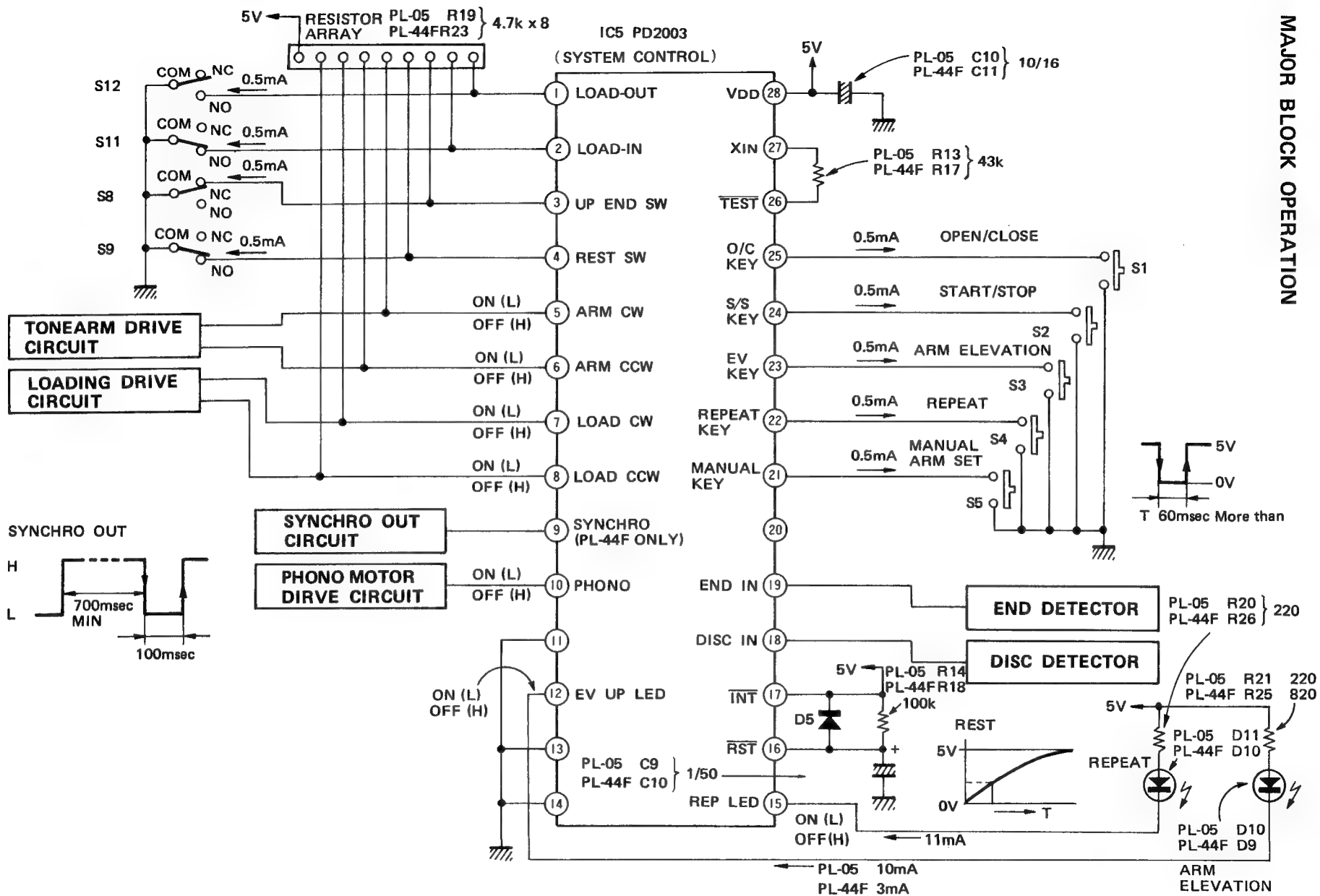
■ Operation Following Pressing of Each Switch

Item	Description
Power ON	<ol style="list-style-type: none"> 1. Input when loading-in or loading-out completed with tonearm in arm rest. Power ON → EV LED on. 2. Input when slide base partially extended with tonearm in arm rest. Power ON → EV LED on → Loading-in. 3. Input when loading-in or loading-out completed with tonearm not in arm rest. Power ON → EV LED on → Tonearm return. 4. Input when slide base partially extended with tonearm not in arm rest. Power ON → EV LED on → Tonearm return → Loading-in.
Turntable ON—OFF IC5 pin 10	<ol style="list-style-type: none"> 1. Turntable platter rotates continually when tonearm not in arm rest. 2. Turntable platter rotates with tonearm in arm rest due to start and restart during repeat play mode (loaded-in completed). 3. Turntable platter stops in all other cases.
OPEN-CLOSE-key IC5 pin 25	<ol style="list-style-type: none"> 1. Input at end of loading-in (EV LED on) (REP. LED on) → (Tonearm return) → Loading-out. 2. Input at end of loading-out. (EV LED on) → (Tonearm return) → Loading-in. 3. Input during loading operation. Loading operation reversed. 4. OPEN/CLOSE key input valid during any operation.
START-STOP key IC5 pin 24	<ol style="list-style-type: none"> 1. Input when tonearm in arm rest. Loading-in → Tonearm lead-in → With record → Tonearm lead-in continued → Without record → Tonearm return EV LED off → Tonearm lowering. 2. Input when tonearm not in arm rest at end of loading-in operation. (EV LED on) (REP. LED off) → Tonearm return. 3. Key input not valid during OPEN/CLOSE key input operation or manual tonearm setting.
ARM ELEVATION key IC5 pin 23	<ol style="list-style-type: none"> 1. Input when tonearm lowering completed or still in progress. EV LED ON → Tonearm elevated. 2. When tonearm elevation completed or when being elevated by EV key operation. EV LED off → Tonearm lowered. 3. Key input not valid in any other state.
REPEAT key IC5 pin 22	<ol style="list-style-type: none"> 1. Input when repeat is off, except in case given in 3 below. REP. LED on. 2. Input when repeat is on, except in case given in 3 below. REP. LED off. 3. ● Key input not valid during manual setting. ● When tonearm is being returned in loaded position, key input valid only when repeat is on, and not valid when repeat is off.
MANUAL ARM SET key IC5 pin 21	<ol style="list-style-type: none"> 1. Input when loading-out completed with tonearm in arm rest. (REP. LED off) → Tonearm lead-in but stop in UP position. 2. Input when loading-out completed with tonearm not in arm rest. (EV LED on) → Tonearm return.
SYNCHRO OUT IC5 pin 9	<ol style="list-style-type: none"> 1. Synchro output obtained when pulses shown in circuit diagram appear at the output at the instant the UP end switch is released and during the timing for that instant. 2. When tonearm is returned by power ON rest, there is no pulse output when the UP end switch is switched on.
END SENSE IC5 pin 19	Return operation due to end detection is valid during and after tonearm DOWN operation, but not valid in any other case, even if input signal is applied.
RECORD SENSE IC5 pin 18	The presence of a record by record detector can be detected during tonearm lead-in operation (excluding tonearm DOWN operation) after loading-in has been completed. Detection is not possible in any other case, even when the relevant input signal is applied.
Other	<ol style="list-style-type: none"> 1. When turntable operation has been stopped in a particular mode, and that status is changed by factors apart from key inputs, outputs are generated to ensure that the former status is restored. 2. See list of fail-safe functions.

Note:









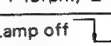













- Operating status enclosed in parenthesis indicate possible conditions due to key input differences.
- Tonearm return and loading operations are always fully completed before commencing the next operation.
- End of loading-in: loading-in of slide base completed.
- End of loading-out: loading-out of slide base completed.

Fig. 4-1 Block diagram



■ IC PD2003

PD2003 Pin Layout

PIN No.	Symbol	I/O Display	Pin Name	Function	Remarks
1	IN01	In	Loading-out SW input	Loading-out position detector switch input Not loaded-out  Loading-out position	
2	IN02	In	Loading-in SW input	Loading-in position detector switch Not loaded-in  Loading-in position	
3	IN03	In	UP end SW input	UP completed position detector switch Not UP  UP position	
4	IN04	In	Arm rest SW input	Arm rest position detector switch Not in arm rest  Rest	
5	OT0 0	Out	Tonearm CW output	Tonearm drive motor output (lead-in, down direction) OFF  ON	
6	OT0 1	Out	Tonearm CCW output	Tonearm drive motor output (return, up direction) OFF  ON	
7	OT0 2	Out	Load CW output	Loading motor output (loading-out direction) OFF  ON	
8	OT0 3	Out	Load CCW output	Loading motor output (loading-in direction) OFF  ON	
9	102 0	Out	Synchro output	Deck synchronization  100msec 700msec	Pull-up resistance
10	102 1	Out	Phono motor output	Phono motor start/stop output OFF  ON	Pull-up resistance
11	OT1 0	Out	Speed indicator output	Phono motor speed indicator H : 45rpm, L : 33rpm	
12	OT1 1	Out	Elevation indicator output	Lamp on during elevation UP operation Lamp off  Lamp on	
13	OT1 2	Out	Manual indicator output	Lamp on when manual ON Lamp off  Lamp on	
14	GND		GND	GND	
15	OT1 3	Out	Repeat indicator output	Lamp on when repeat ON Lamp off  Lamp on	
16	RST	In	RST	CPU initialization reset input Reset  Normally H	
17	INT	In	INT	(Not used) Normally H	
18	100 3	In	Record detector input	Record presence detector input Present  Absent	
19	100 2	In	End detector input	End detector input OFF  ON	
20	100 1	In	Speed key input	Speed selector key input OFF  ON	Pull-up resistance
21	100 0	In	Manual key input	Manual arm set key input OFF  ON	Pull-up resistance
22	101 3	In	Repeat key input	Repeat set/rest key input OFF  ON	Pull-up resistance
23	101 2	In	Elevation key input	Elevation up/down key input OFF  ON	Pull-up resistance
24	101 1	In	Start/stop key input	Start/stop key input OFF  ON	Pull-up resistance
25	101 0	In	Open/close key input	Open/close key input OFF  ON	Pull-up resistance
26	TEST		TEST	Supply of basic clock signals via resistance connections for LSI testing.	
27	XIN		XIN	Basic clock pin	20~500kHz
28	VDD		VDD	+5V	

See Fig. 4-1 for the block diagram.

■ Control Circuit

Full auto turntable operation is controlled entirely by the system control IC (IC5) PD2003.

Output signals determined according to key inputs at pins 21 thru 25, sensor inputs at pins 18 and 19, and switching inputs at pins 1 thru 4, appear as the output signals at pins 5 thru 10, 12 and 15.

■ Tonearm Drive Circuit

Consists of the tonearm drive motor IC (IC4) BA6208 and the tonearm drive motor.

■ Loading Drive Circuit

Consists of the slide base drive IC (IC3) BA6109 and the slide base drive motor.

■ Synchro Output Circuit

Formed by transistors Q7 and Q8 with the DECK SYNCHRO switch S6.

When the turntable is connected to a tape deck by the JC-60 connecting cord, the tapedeck pause mode can be released for automatic start of recording mode when the turntable play mode is started. And when turntable play mode is completed, the tape deck is returned automatically to pause mode.

Note that this circuit is not included in the PL-05 model.

List of Fail Safe Functions

Function	Description	Remarks
Prevention of key input chattering	Program for discriminating signals from noise generated by chattering in switches used in the operation keys, and switches are pressed in succession.	Chattering absorption time: times of less than 30msec are detected as noise, while times greater than 60msec are detected as signals.
Key input processing	Program for checking key input sequence and validity of input when operation keys are pressed more than once.	
Noise discrimination function	Program for detecting noise generated in the power supply and fluorescent lamps, and electrostatic noise in sensor and key inputs, thereby preventing misoperation due to noise sources.	
Switch delay time	Program for distinguishing noise from signals in all mode status switches, and also for processing surplus time in mechanism operations.	Switching time: times less than 70msec are interpreted as noise, and times greater than 130msec are interpreted as signals.
Cartridge protection	If the power is switched off before the tonearm is returned to the arm rest, it is properly returned to the rest when the power is next switched on again.	
Initialization setting	If the power is switched off during loading operation, the slide base is loaded back into the turntable when the power is next switched on.	
Loading motor protection	If the slide base is locked for more than a certain fixed period of time during loading operation, or when there is no loading-in or loading-out switch input, the LED blinks on and off, and all motor outputs are stopped. If the O/C key is pressed within a fixed period of time, time is counted again from the key input. To release this condition, press the O/C key again, or switch the power off and on. The slide base is subsequently loaded in.	Fail safe time: 25 sec. (typ)

■ Phono Motor Drive Circuit

Consists of transistor Q4 and the phono motor.

■ Operation Stage

Includes the OPEN/CLOSE switch S1, START/STOP switch S2, ARM ELEVATION switch S3, REPEAT switch S4, MANUAL ARM SET/CUT switch S5, and other switches used in turntable operation.

■ End Detector Circuit

Consists of the end sensor board plus transistors Q1 and Q2.

In the PL-44F and PL-5 models, the turntable platter is stopped(phono motor stopped) and the tonearm returned to the arm rest automatically when the end of record play is reached. This circuit detects the end of record play, and generates an output signal at pin 19 of IC5 to execute the above operations.



■ Record Detector Circuit

Consists of lamp L1, photosensitive transistor Q6, and transistor Q5.

When auto play mode is selected when no record has been placed on the turntable platter, play is not activated when the START/STOP key is pressed. This ensures stylus protection.

4.2 AUTO PLAY MODE

■ IC5 (PD2003) Pin Status when Power is Switched on during Auto Play Mode

PD2003 Pin No.		Level	PD2003 Pin No.		Level
Loading-out SW input	1	H	Repeat indicator output	15	H
Loading-in SW input	2	L	RST	16	H
UP end SW input	3	L	INT	17	H
Arm rest SW input	4	L	Record detector input	18	—
Tonearm CW output	5	H	End detector input	19	H
Tonearm CCW output	6	H	Not used	20	H
Load CW output	7	H	Manual key input	21	H
Load CCW output	8	H	Repeat key input	22	H
Synchro output	9	H	Elevation key input	23	H
Phono motor output	10	H	Start/stop key input	24	H
Not used	11	L	Open/close key input	25	H
Elevation indicator output	12	L	TEST	26	
Not used	13	L	XIN	27	
GND	14	GND	VDD	28	5V

The above pin status exist when the slide base has been loaded-in, the tonearm is in the arm rest, and all motors are off. Status stabilized after the power is switched on also include loaded-out status (in this case, however, pin 1 is switched to L, and pin 2 to H level).

■ Auto Play

- When the power switch S14 is switched on, the PD2003 pins stabilize at the levels listed in the above table. (If the power is switched on with the turntable in an operating status, the above levels are attained after completion of initialization resetting). Pin 12 of IC5 is switched to L level, and the UP LED D9 (D10) is turned on.
- When the OPEN/CLOSE key (open/close switch) S1 is pressed, pin 25 of IC5 is switched to L level. Pin 7 of this IC5 is also switched to L while pin 8 is switched to H level, resulting in an L level signal being applied to pin 5 of IC3 and an H level signal to pin 6.
- Since this generates an L level output at pin 2 of IC3 and an H level output at pin 10, the loading drive motor starts to rotate in the loading-out operation direction (clockwise). The door is opened, and the slide base moves forward.
- When the slide base moves out as far as possible, a projection on the slide base pushes the load-out switch S12 on, resulting in an L level input being applied to pin 1 of IC5.
- Pins 7 and 8 of IC5 are switched to H level, and this level is applied to pin 5 of IC3, switching pin 2 of that IC to L level. The loading drive motor is stopped as a result.

- When a record is placed on the turntable platter, the record detector circuit generates an H level signal which is applied to pin 18 of IC5. IC5 thus detects the presence of a record (see section 4-8, "Record Detector Circuit").
- When the SPEED key (speed selector switch) S7 is pressed (see section 4-9, "Speed Indicator Circuit"), the 45rpm speed is normally selected and the 45 indicator LED D8 is turned on. The 33rpm indicator LED D7 is turned off.
- When the START/STOP key (start/stop switch) S2 is pressed, pin 24 of IC5 is switched to L level. Pin 8 of this IC5 is also switched to L level, and this in turn switches pin 6 of IC3 to L level. Pin 2 of IC3 is thus switched to H level and pin 10 to L level, resulting in the loading drive motor being rotated in the loading-in direction (counter clockwise) to pull the slide base back into the turntable. The door is closed by this movement.
- When the slide base is fully inserted, the load-in switch S11 is switched on, resulting in pin 2 of IC5 being switched to L level. Since this returns pin 8 of IC5 to H level, the loading drive motor is stopped.
- The L level at pin 2 of IC5 also switches pin 5 to L level, resulting in an H level output at pin 6. The input applied to pin 2 of IC4 is thus H level, and the input applied to pin 3 L level.
- This results in an H level output at pin 7 of IC4 and an L level output at pin 8. The tonearm drive motor starts to rotate in the lead-out direction (clockwise), moving the tonearm over toward the record.
- When the tonearm leaves the are rest, the rest switch S9 is switched off by the drive plate (see description of mechanical operations). Pin 4 of IC5 is thus switched to H level, resulting in an L level output from pin 10 of the same IC.
- With pin 10 of IC5 at L level, Q4 is turned off and Q3 turned on, thereby starting up the phono motor.
- When the tonearm stylus reaches the lowering position, the UP switch S8 is switched off, and pin 3 of IC5 is switched to H level.
- As the drive plate rotates further, the elevation shafts starts to drop when the slope section of the drive plate is reached. The stylus is thus lowered onto the record at the lead-in groove.
- After the tonearm stylus is lowered, a projection on the drive plate which had pushed the muting switch S13 on passes by to release the switch again.

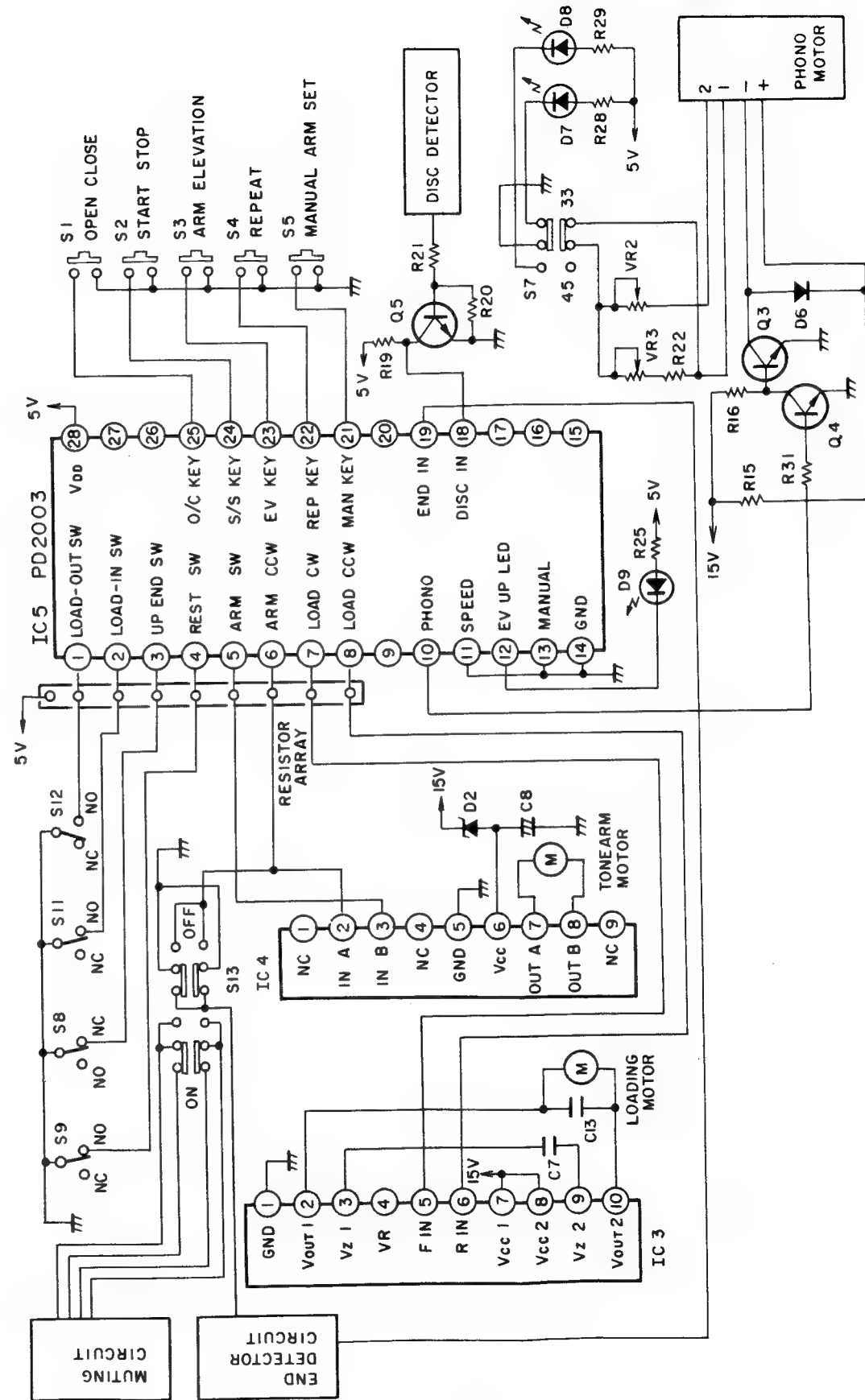


Fig. 4-2 Block diagram

17. When S13 is switched off, pin 2 of IC4 is switched to L level. Pins 7 and 8 are also switched to L, resulting in stopping of the tonearm drive motor.
- At the same time, the cartridge output is disconnected from ground, thereby releasing the muting action.
18. The UP LED D9 (D10) is turned off when the load-in switch S11 is switched off.

■ Arm Elevation Up and Down Operations

1. If the ARM ELEVATION key (arm elevation switch) S3 is pressed during play mode, pin 23 of IC5 is switched to L level.
 2. Pin 5 of IC5 is thus switched to H level, followed by pin 3 of IC4 also being switched to H. The tonearm drive motor is thus rotated counter clockwise, switching the muting switch S13 on and raising the tonearm.
 3. When the drive plate pushes the UP switch S8 on, pin 3 of IC5 is switched to L level, followed by pin 5 also being switched to L. As a result, the tonearm drive motor is stopped.
 4. If the ARM ELEVATION key S3 is pressed again, pin 23 of IC5 is switched to L level. Since this results in pin 6 being switched to H level, the tonearm drive motor starts to rotate clockwise.
- Subsequent steps are the same as for auto play from step 16 on.

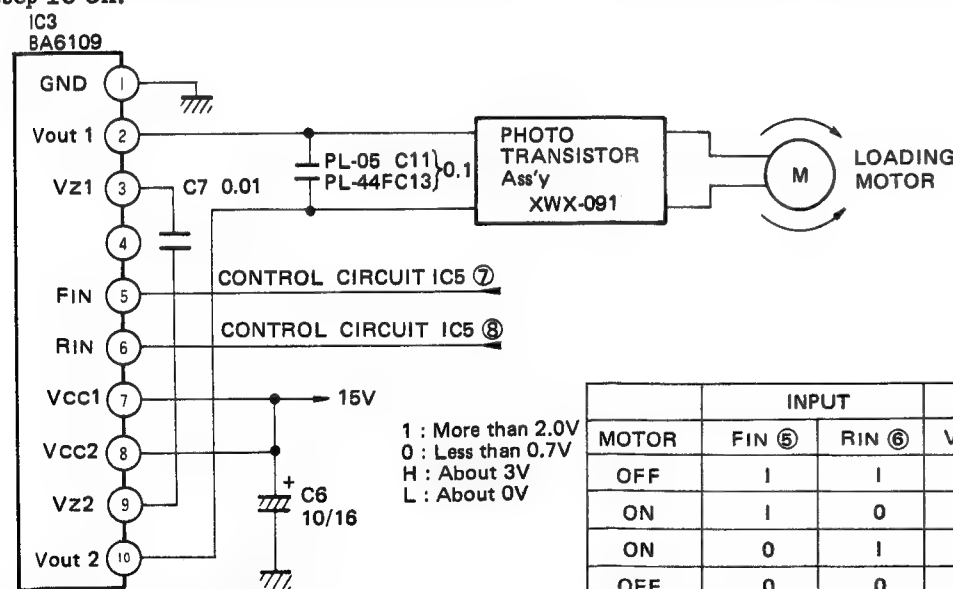


Fig. 4-3 Loading drive circuit

Operation mode

	FIN ⑤	RIN ⑥	Vout1 ②	Vout2 ⑩
Stop	H about 4V	H about 4V	L about 0V	L about 0V
Loading-in (CCW)	H about 4V	L about 0V	H about 13V	L about 0V
Loading out (CW)	L about 0V	H about 4V	L about 0V	H about 13V

■ Auto Return

1. When the stylus enters the lead-out groove at the end of record play, the end detector circuit (see section 4-7, "End Detector Circuit") is activated, and an L level input is applied to pin 19 of IC5.
2. Since this results in pin 5 of IC5 and pin 3 of IC4 being both switched to H level, the tonearm drive motor starts to rotate counter clockwise.
3. Subsequent steps are the opposite to auto mode operation.

4.3 LOADING DRIVE CIRCUIT

The loading drive circuit is outlined in Fig. 4-3. Input signals from pins 7 and 8 of IC5 are applied to pins 5 and 6 of IC3, resulting in H or L level outputs appearing at pins 2 and 10 of IC3. These outputs result in rotation of the loading drive motor.

The motor is driven by a 230mA current when starting up and a 45mA current when constant speed is attained. The application voltage is about 13V. The motor is rotated in the loading-in operation direction (counter clockwise) when pin 2 is at H level and pin 10 at L level, and in the loading-out operation direction (clockwise) when pin 2 is at L level and pin 10 at H level. If both pins are at H level, the motor stops.

4.4 TONEARM DRIVE CIRCUIT

See Fig. 4-4 for an outline of the tonearm drive circuit. Input signals from pins 5 and 6 of IC5 are applied to pins 2 and 3 of IC4, resulting in H or L level outputs appearing at pins 7 and 8 of IC4. These outputs result in rotation of the tonearm drive motor.

The motor is driven by a 60mA starting current and a 15mA constant speed current at a voltage of about 8V.

The motor rotates so as to move the tonearm towards outer edge of the record (clockwise motor rotation) when pin 7 is at H level and pin 8 at L level, and towards the center spindle (counter clockwise motor rotation) when pin 7 is at L level and pin 8 at H level.

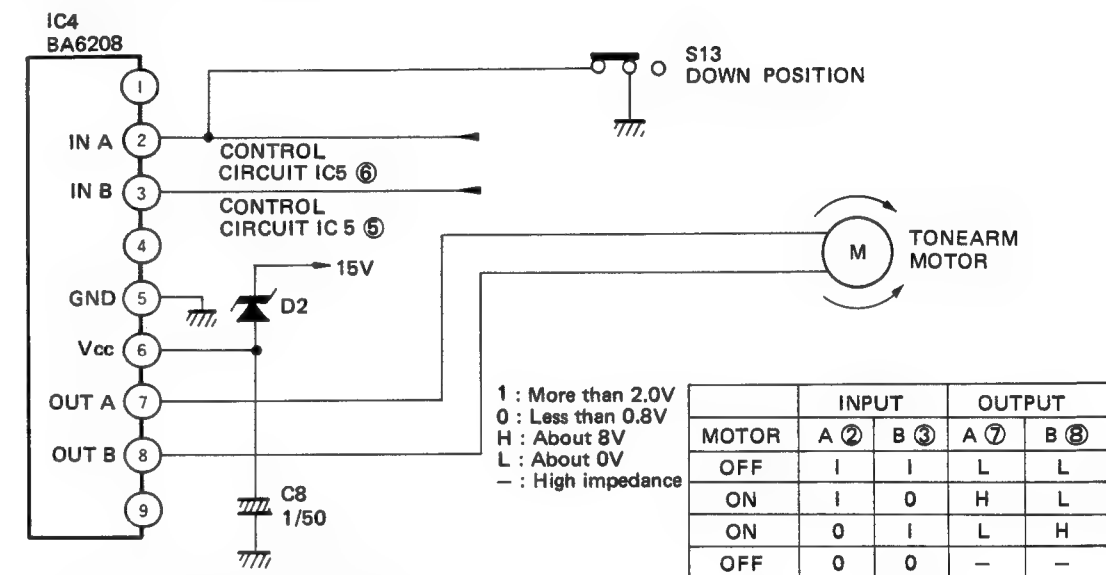


Fig. 4-4 Tonearm drive circuit

Operation mode

	INPUT A ②	INPUT B ③	OUTPUT A ⑦	OUTPUT B ⑧
Rest stop and EV UP stop	H About 4V	H About 4V	L About 0V	L About 0V
Down stop	L About 0V	L About 0V	- About 0V	- About 0V
Lead-in and down (CW)	H About 4V	L About 0V	H About 8V	L About 0V
Return and UP (CCW)	L About 0V	H About 4V	L About 0V	H About 8V

4.5 PHONO MOTOR DRIVE CIRCUIT

See Fig. 4-5 for an outline of the phono motor drive circuit.

When pin 10 of IC5 is switched to L level, transistor Q4 is turned off. +B (15V) is thus passed via resistor R16 (R12) to the base of Q3 which is turned on to start the phono motor.

When pin 10 of IC5 is switched to H level, Q4 is turned on and Q3 turned off, thereby stopping the phono motor.

The phono motor is driven by a 250mA starting current at 7V, and a 60mA constant speed current at 13V.

The motor can be stopped in two modes. In rest stop and EV up stop modes, the pin 2 and 3 inputs are both H level, while in down stop mode, pins 2 and 3 are both at L level (thereby stopping the motor).

This is due to pin 2 of IC5 being switched to L level when the load-in switch S11 is switched on during slide base load-in operation. Pins 5 and 6 are thus switched to L level, resulting in L level inputs being applied to pins 2 and 3 of IC4. However, since the tonearm drive motor was stopped in this condition, the tonearm cannot be lowered. Pin 6 of IC5 is thus switched to L level by the muting switch S13.

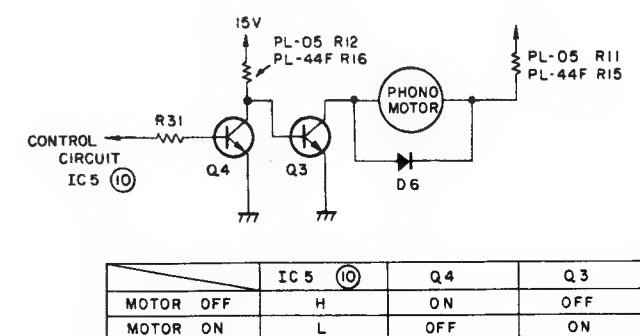


Fig. 4-5 Phono motor drive circuit

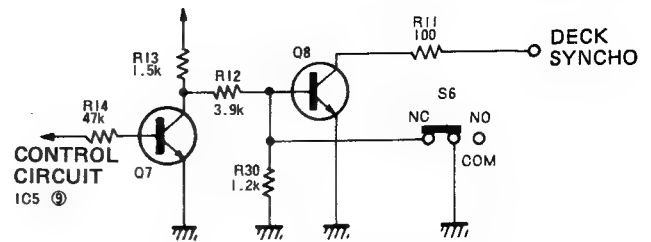
4.6 SYNCHRO OUTPUT CIRCUIT (PL-44F)

See Fig. 4-6 for relevant circuit.

When an L signal from IC5 is applied to the base of Q7, that transistor is turned off. If the DECK SYNCHRO switch S6 is on, Q8 is turned on and an L level appears at the synchro terminal.

If an H level signal is applied to Q7 from IC5, Q7 is turned on and Q8 turned off.

With the DECK SYNCHRO switch off, the Q8 base potential is kept at ground level and Q8 remains off.



S6	IC5 (9)	Q7	Q8
Open	H	ON	OFF
Open	L	OFF	ON
Short	H	ON	OFF
Short	L	OFF	OFF

Fig. 4-6 Synchro output

4.7 END DETECTOR CIRCUIT

See Fig. 4-7 for relevant circuit.

- When the tonearm approaches to within 120mm from center spindle, the shutter coupled to the tonearm moves between lamp L2 and the CdS element, thereby starting to shade the CdS element from the light.
- The CdS resistance is thus gradually increased, thereby reducing the current flowing through the Q1 collector (base potential remains constant). As the collector potential increases, a potential difference is generated between test points TP1-1 and TP1-2.
- This voltage is passed via D3 (peak hold diode) to the differentiating circuit formed by C12, R6, and R7 (R8).

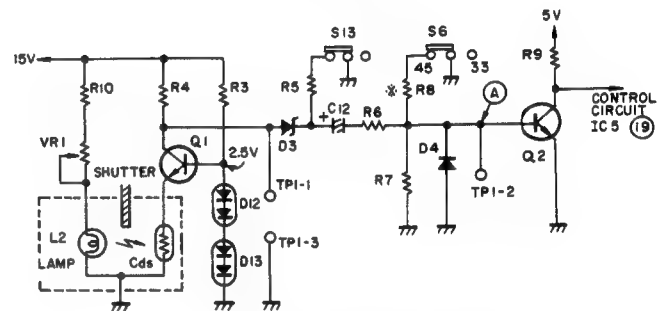


Fig. 4-7 End detector circuit

The PL-05 also includes a 680k resistor at R8 to enable the differentiating circuit time constant to be changed for 33rpm and 45rpm speeds.

- When the stylus enters the lead-out groove (where the speed of tonearm movement is increased, and the speed signal is likewise increased), the differential signal is increased. When the potential at point A reaches approximately 0.6V, Q2 is turned on, and an L level signal is applied to pin 19 of IC5.

● Peak hold diode

Used to prevent detection of voltages changes due to record eccentricity during tonearm return to the arm rest.

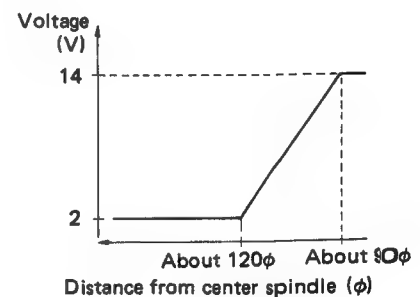


Fig. 4-8 Standard waveform

4.8 RECORD DETECTOR CIRCUIT

See Fig. 4-9 for relevant circuit.

- When the slide base is in normal loaded-in position, lamp L1 (which also serves as an internal illuminating lamp) on the escutcheon cover and the photosensitive transistor Q6 on the slide base cover form a positional relation with each other.
- When there is no record on the turntable platter in this case, light from lamp L1 is directed onto the photosensitive transistor Q6 through three slits in the rubber place mat and turntable platter.

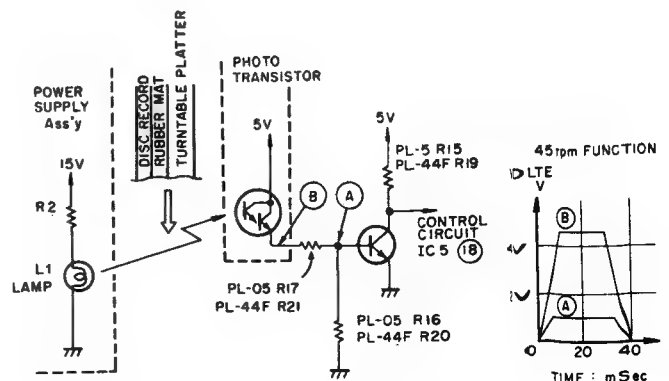


Fig. 4-9 Record detector circuit

3. The Q6 emitter (point B) voltage is divided by the resistance of R20 and R21 (R16 and R17) to provide the potential at point A. If the potential is increased by about 0.6V, Q5 is turned on, the collector potential drops, and an L level input is applied to pin 18 of IC5.
4. When there is a record on the turntable platter, on the other hand, Q6 is shaded from the L1 light beam. Q5 remains off, and the input applied to pin 18 of IC5 is an H level signal.

Note:

- When transparent, semi-transparent, or red colored records are used, or when the slide base is left out in the loaded-out position, the potential at point A is not stable, depending on the type of record and the amount of external light.
- The waveform between points A and B undergoes a shift in time base axis when the record speed is changed. This axis is increased by about 1.35 times for 33rpm.

4.9 SPEED INDICATOR CIRCUIT

The speed indicator circuits are different in the PL-44F and PL-05 models.

■ PL-44F

See Fig. 4-10 for relevant circuit.

33/45 switching of the speed switch S7 switches the (85) and (86) GND pins.

(85) GND when 33rpm

(86) GND when 45rpm

■ PL-05

See Fig. 4-10 for relevant circuit.

33/45 switching of the speed switch S6 switches (85) to GND and OPEN.

At 33rpm, (85) is connected to GND and D7 is turned on.

The potential at point A is dropped by D9 being turned on at this time, resulting in D8 being turned off.

At 45rpm, (85) is switched to OPEN. D7 and D9 are turned off, and D8 is turned on.

4.10 POWER CIRCUIT

(mA)

Mode	I ₀	I ₁	I ₂
When all operation has stopped	210	155	55
Play	270	220	50
Loading	290	235	55
Loading lock	460	405	55
Phono motor lock	450	395	55
Lead-in return	230	175	55
Lead-in return lock	280	225	55

* I₀ ≡ I₁ + I₂

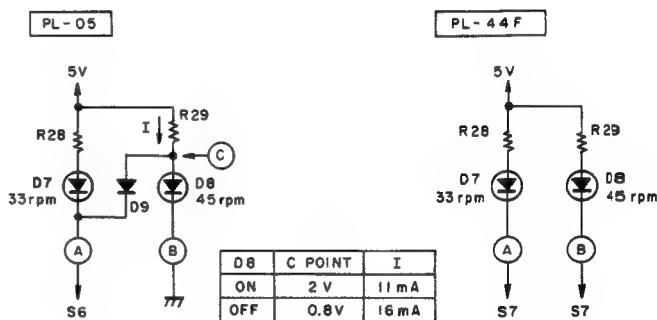


Fig. 4-10 Speed indicator circuit

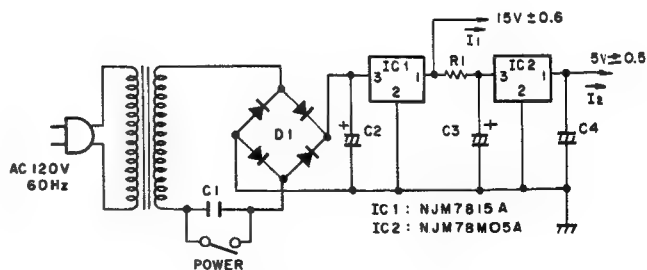


Fig. 4-11

4.11 Rotation Motor Stopping Circuit (Only on KU type)

If movement of the slide base is obstructed after it has begun moving in or out, the stopping circuit described below functions to halt movement of the slide base.

1. Movement of the slide base is controlled by the loading motor.
2. If movement of the slide base is obstructed after it has begun to move, the current I_m going to the loading motor will increase (Fig. 4-13).
3. When I_m exceeds the threshold level of Q9, Q9 turns on, Q10 turns off and C14 is charged as 5 volts goes from R36 to R37 to C14 (about one second).
4. After about one second, Q11 turns on, pin 16 of IC5 goes to L and IC5 goes to the reset status.
5. As a result, the rotations of the loading motor halt and the slide base stops moving.
6. To cancel this status, perform the following steps:

- * Remove the obstruction.
- * If the slide base stopped on the way out, press the OPEN/CLOSE switch.
- * If the slide base stopped on the way in, turn off the power switch and turn it back on again.

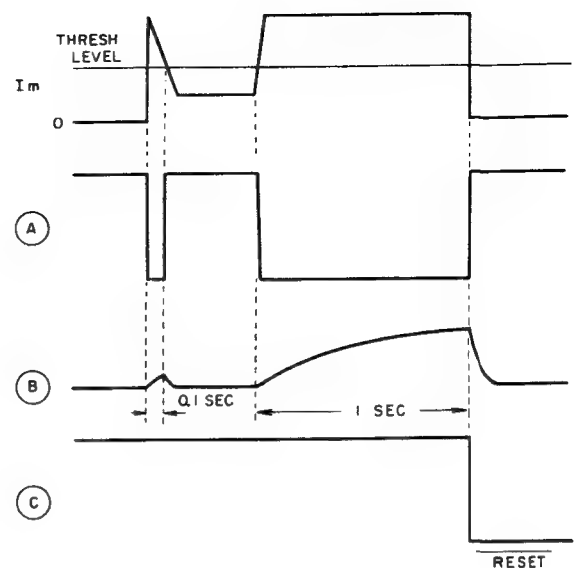


Fig. 4-12

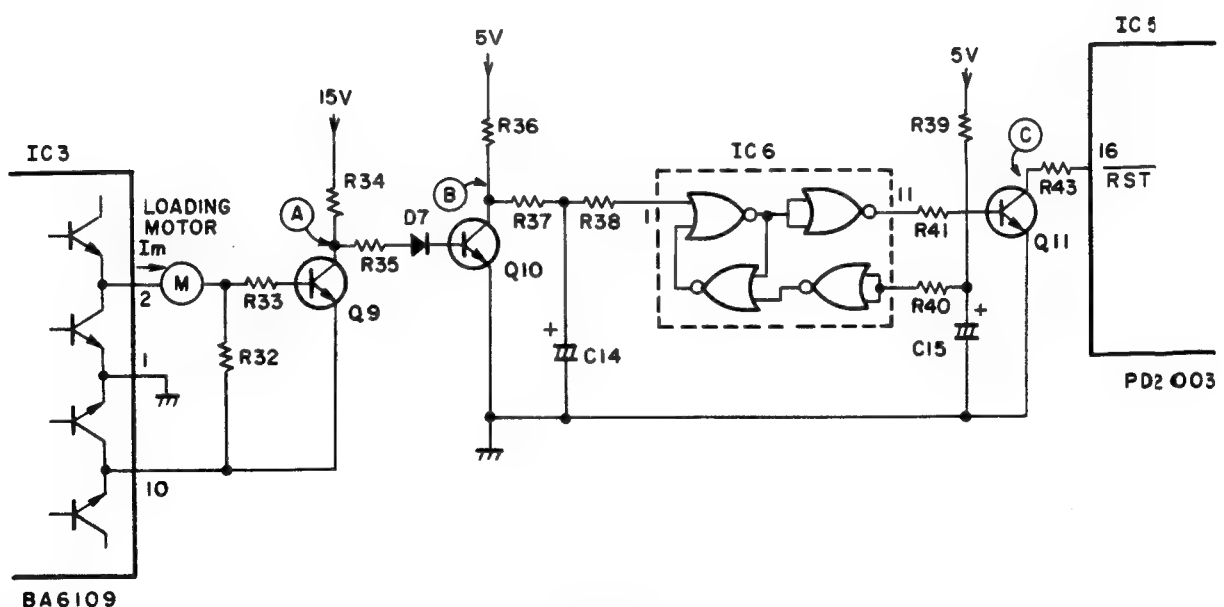


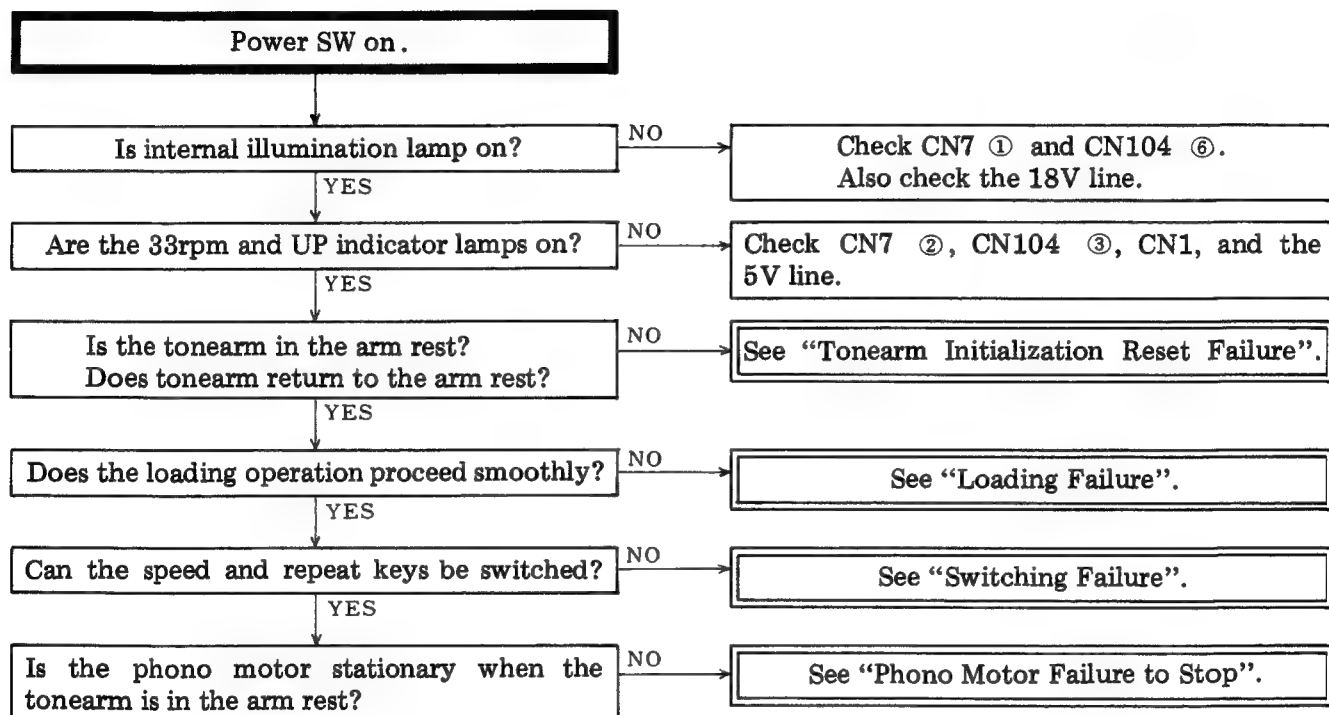
Fig. 4-13

5. TROUBLESHOOTING

5.1 PL-88F

- Items enclosed by are described in greater detail in later check charts.

■ Failure Confirmation



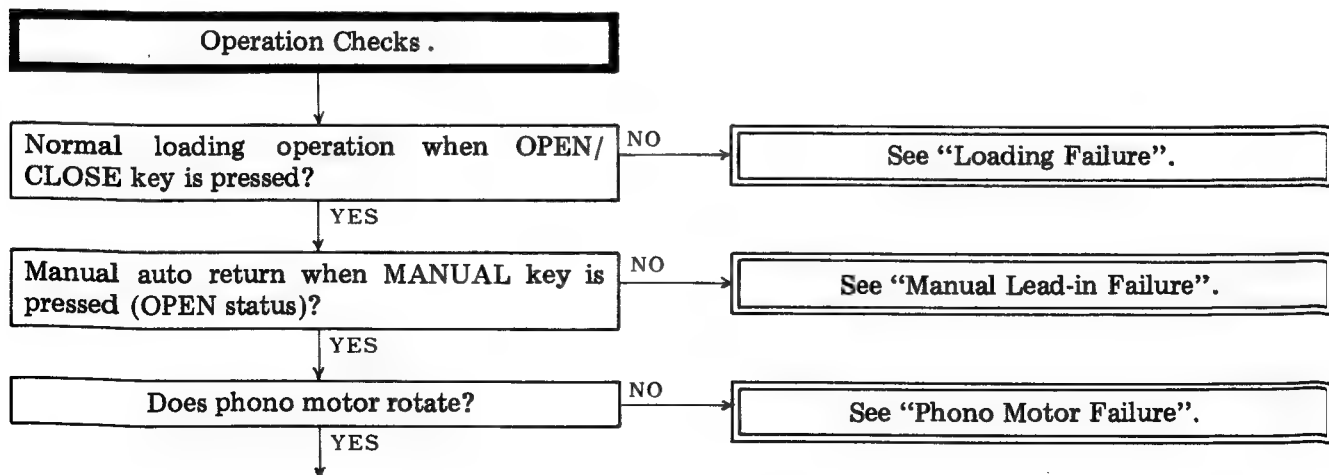
■ Operation Checks

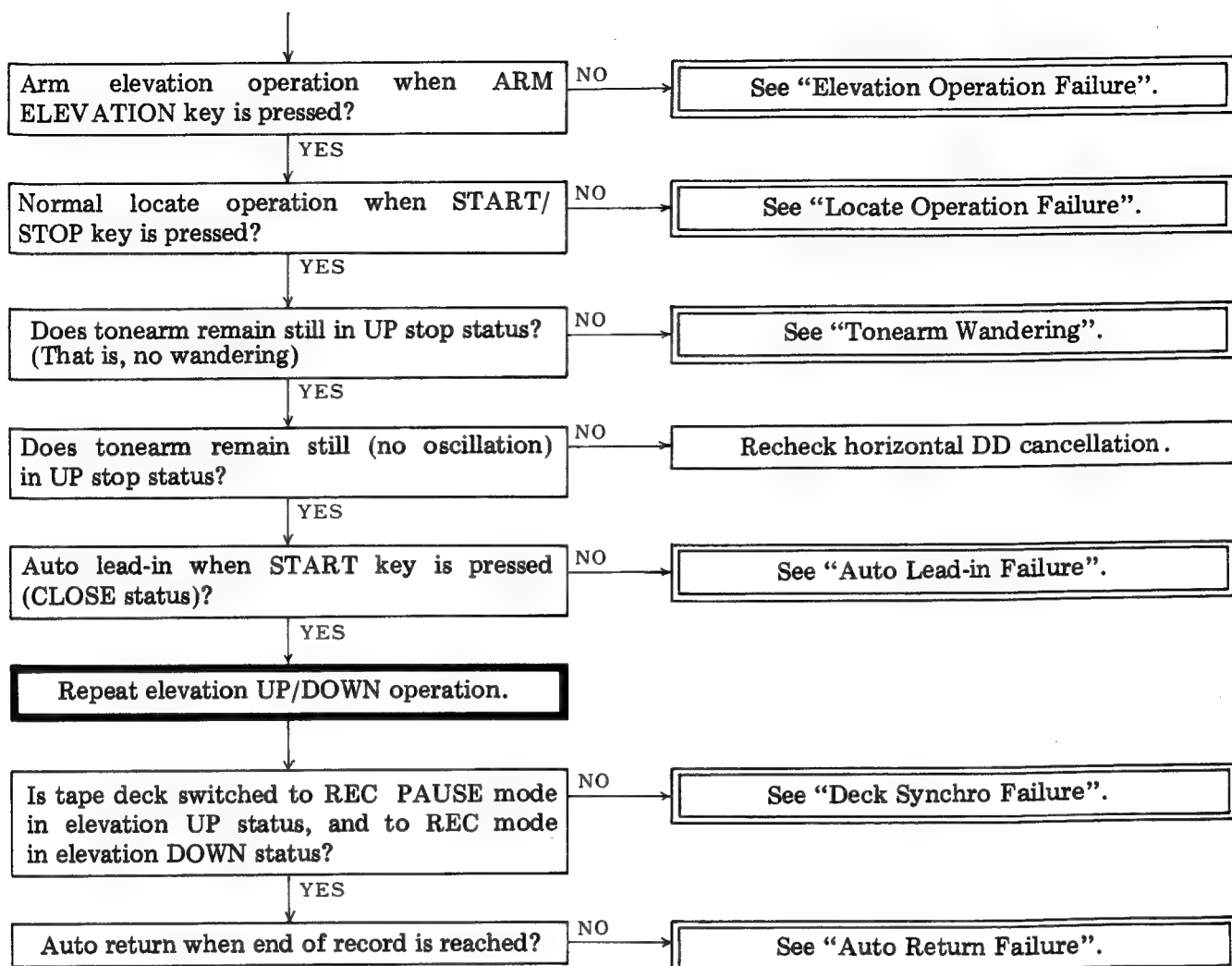
Note:

Perform the following settings before checking operations.

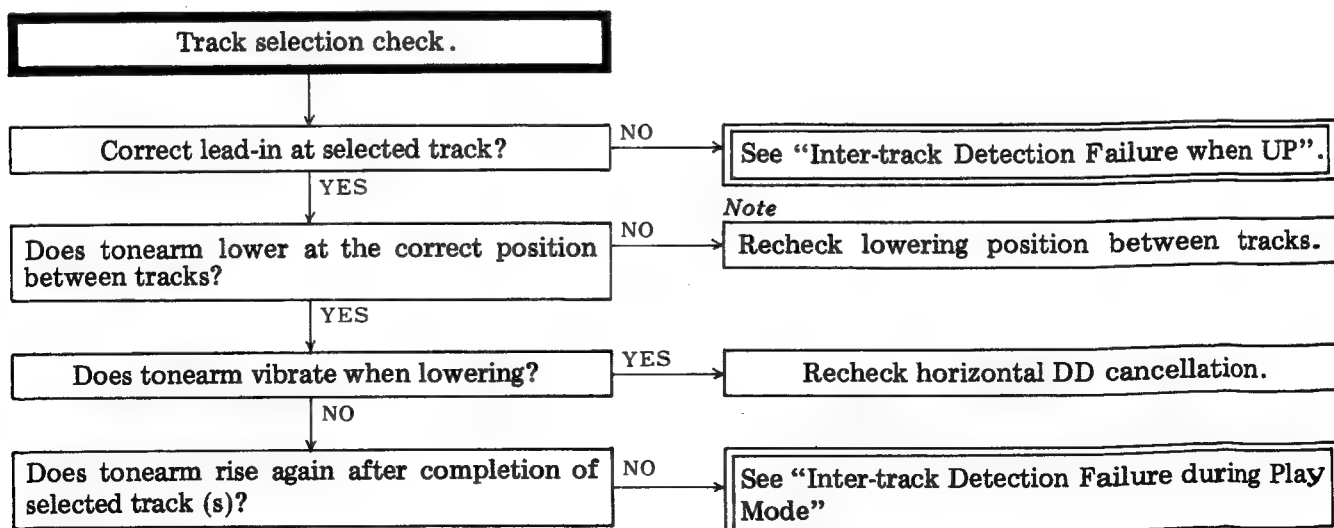
Connect to tape deck with JC-60 cord and switch the DECK SYNCHRO switch on.

Check that the UP LED is on, and put the tape deck into REC PAUSE mode.





■ Track Selection Check

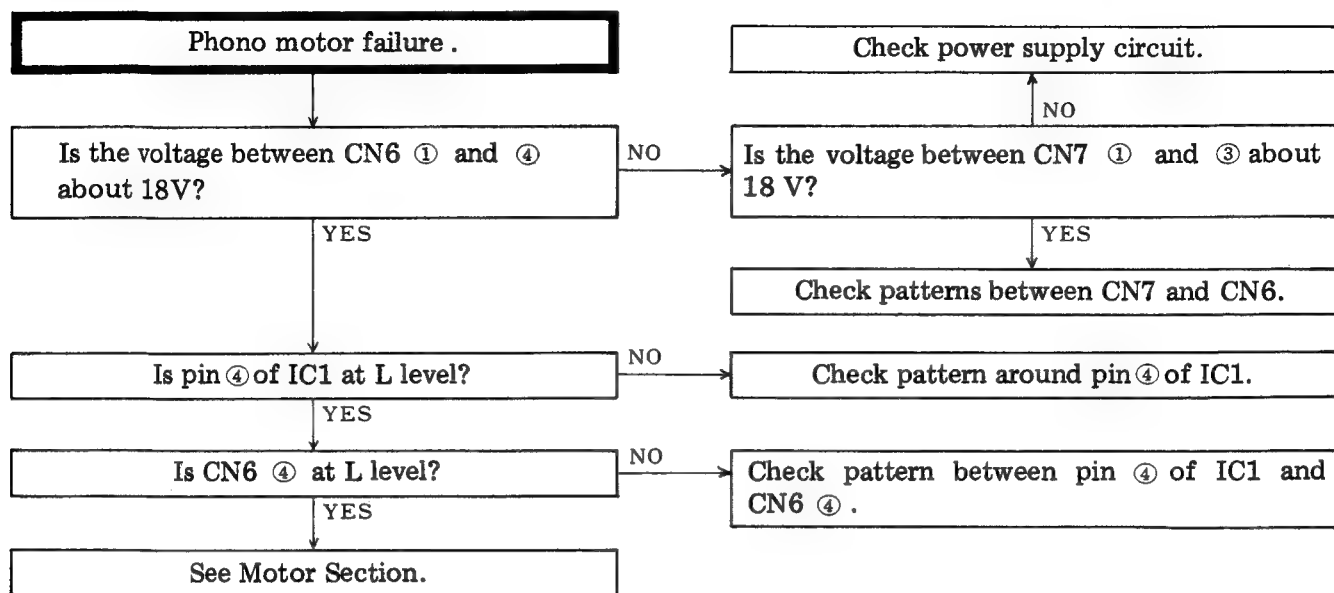


Note:

This cannot be corrected if sound tracks are cut in the inter-track area, or if the inter-track area is very narrow.

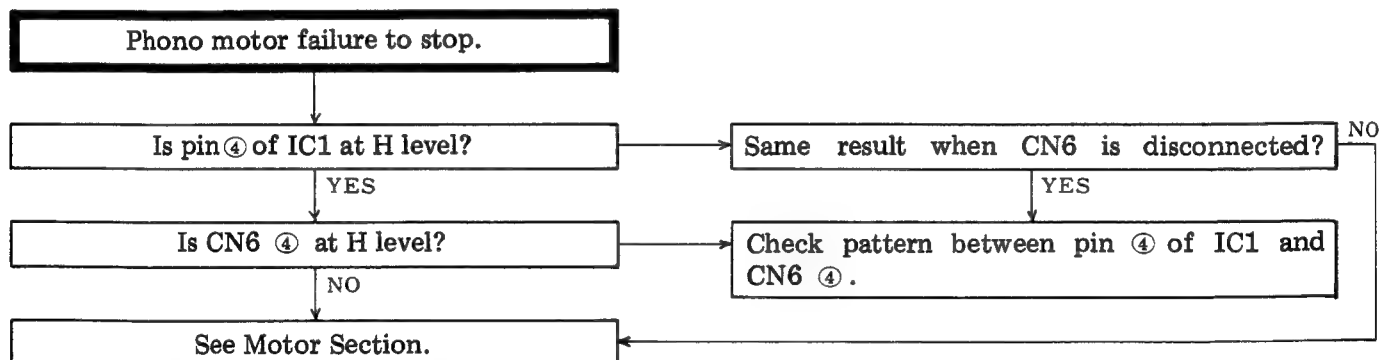
■ Phono Motor Failure

* First check that CN9 has not been shorted and that CN6 has not become loose.

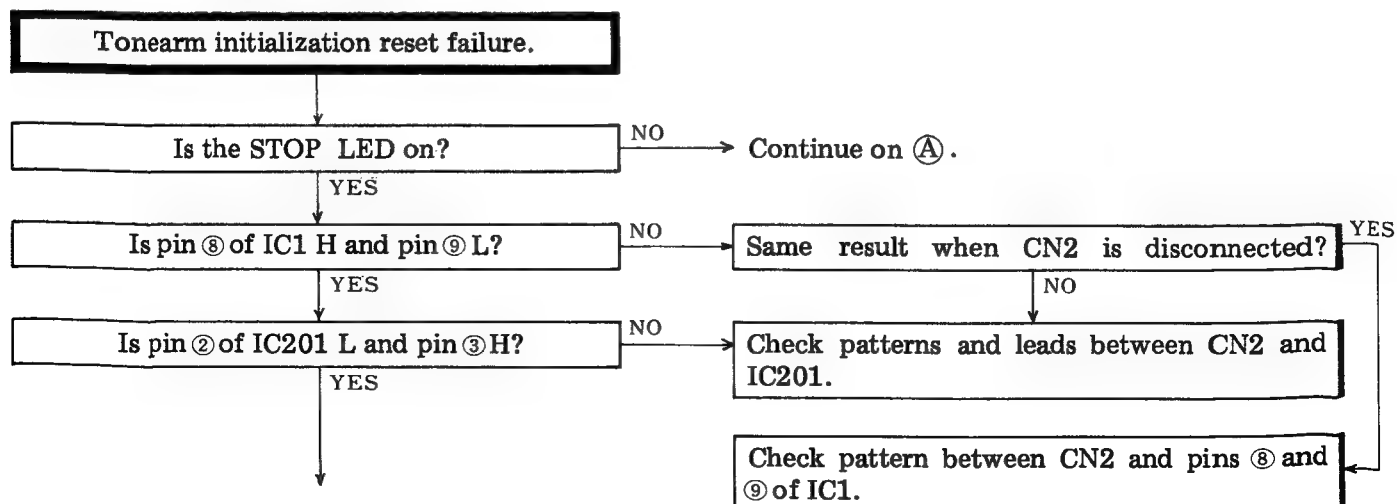


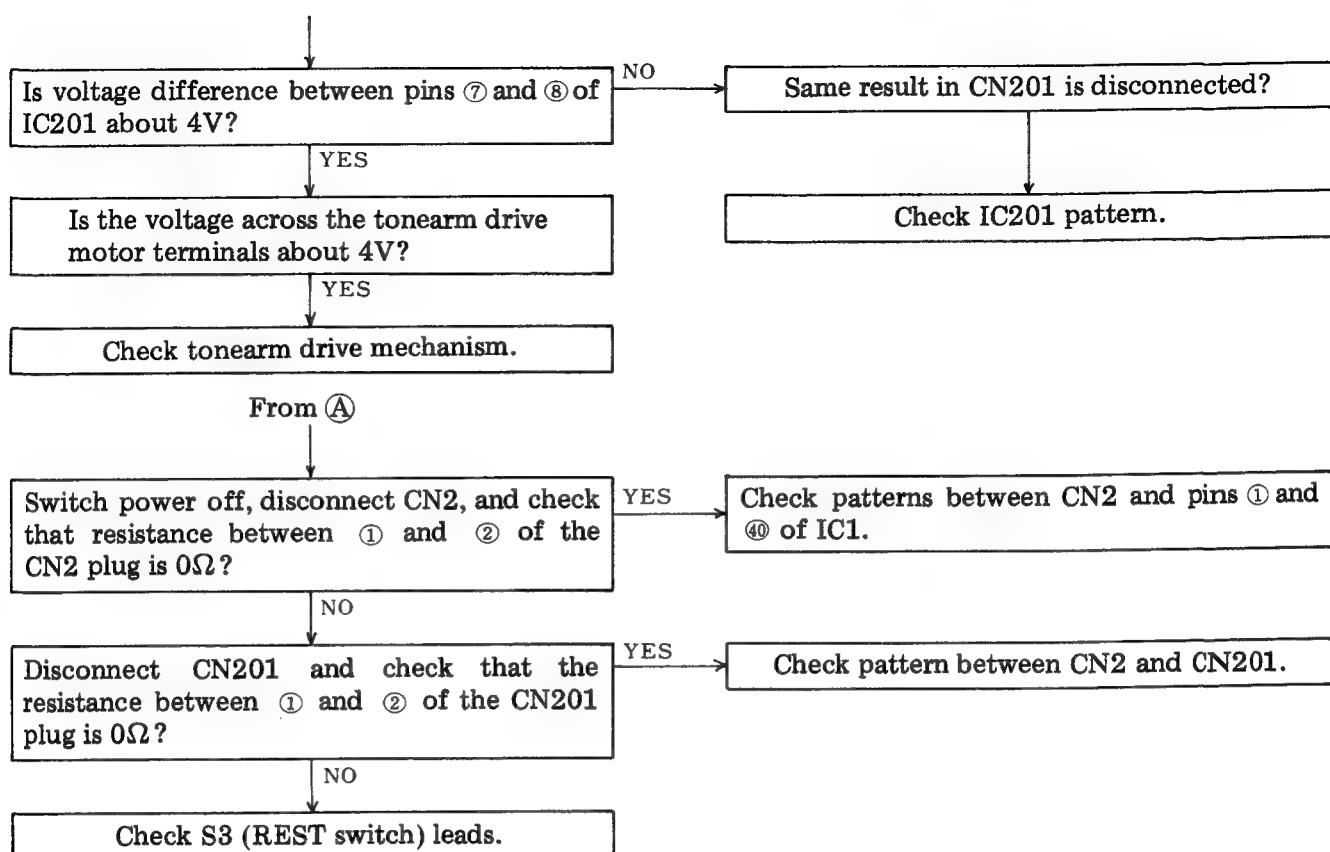
■ Phono Motor Fails to Stop

* Check with the tonearm in the arm rest.



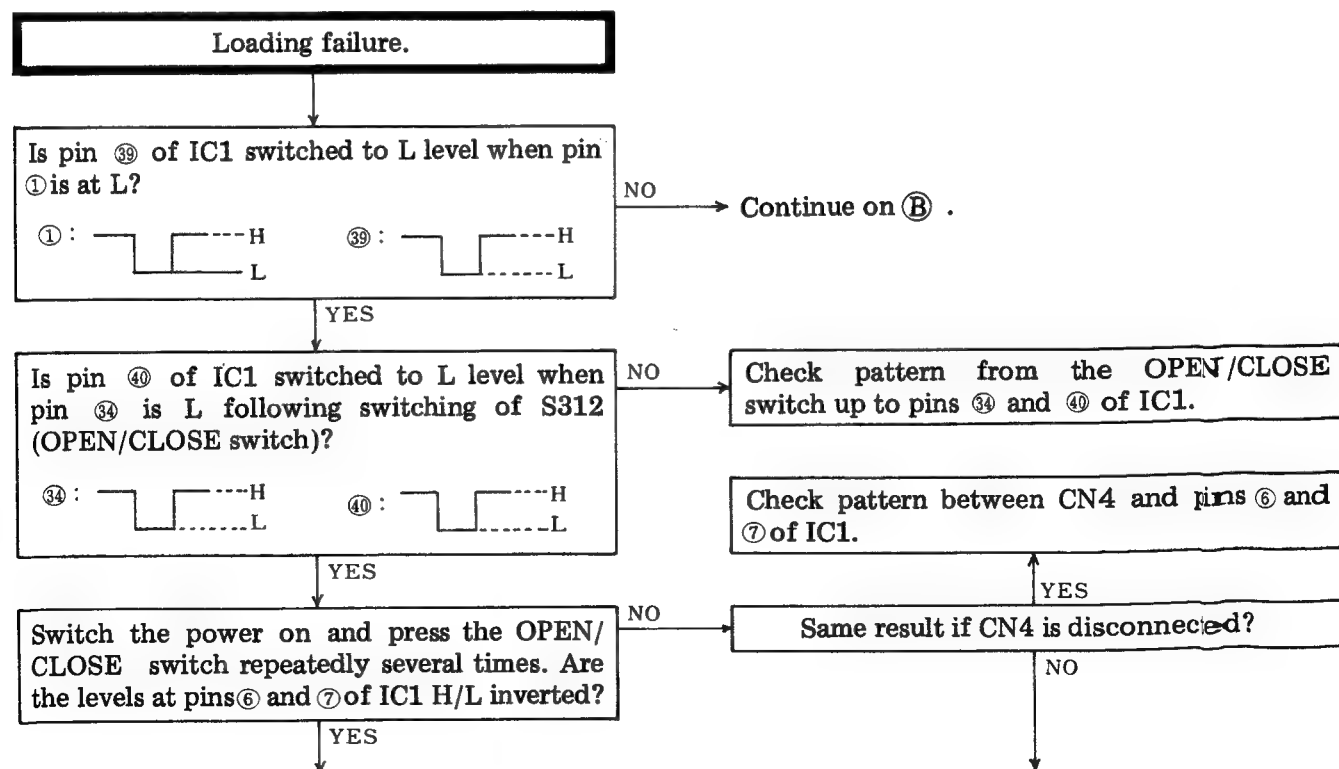
■ Tonearm Initialization Reset Failure

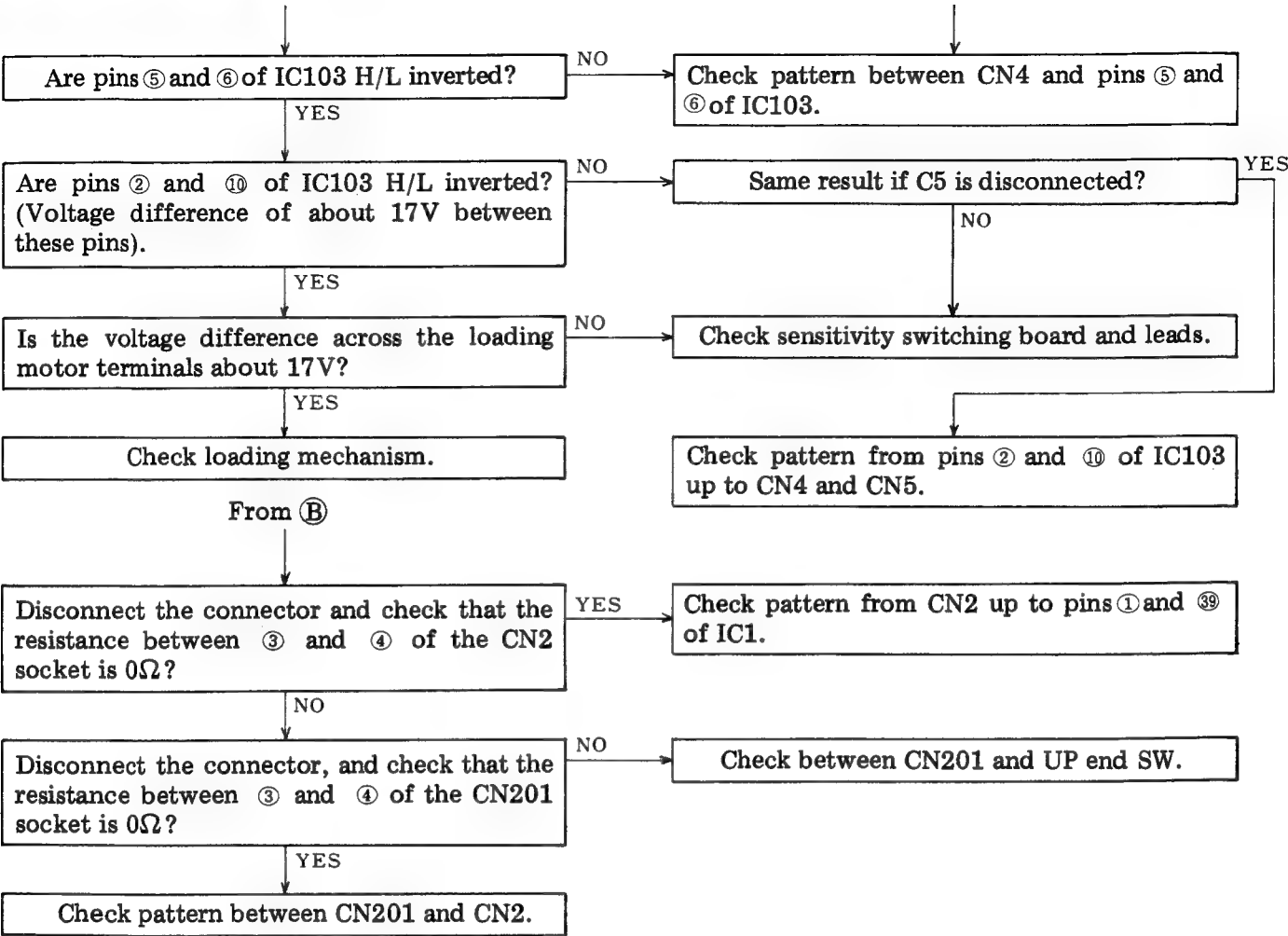




■ Loading Failure

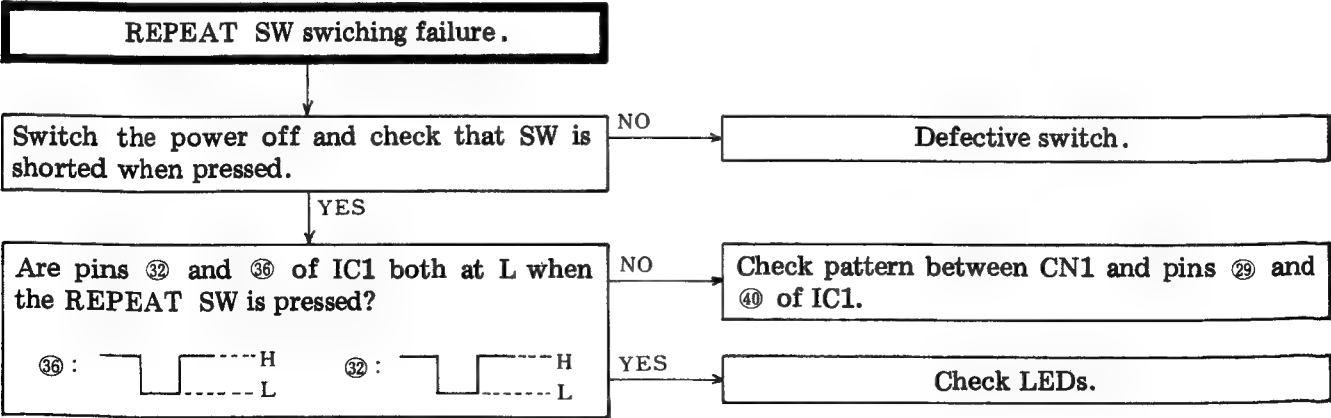
* Check elevation UP end.





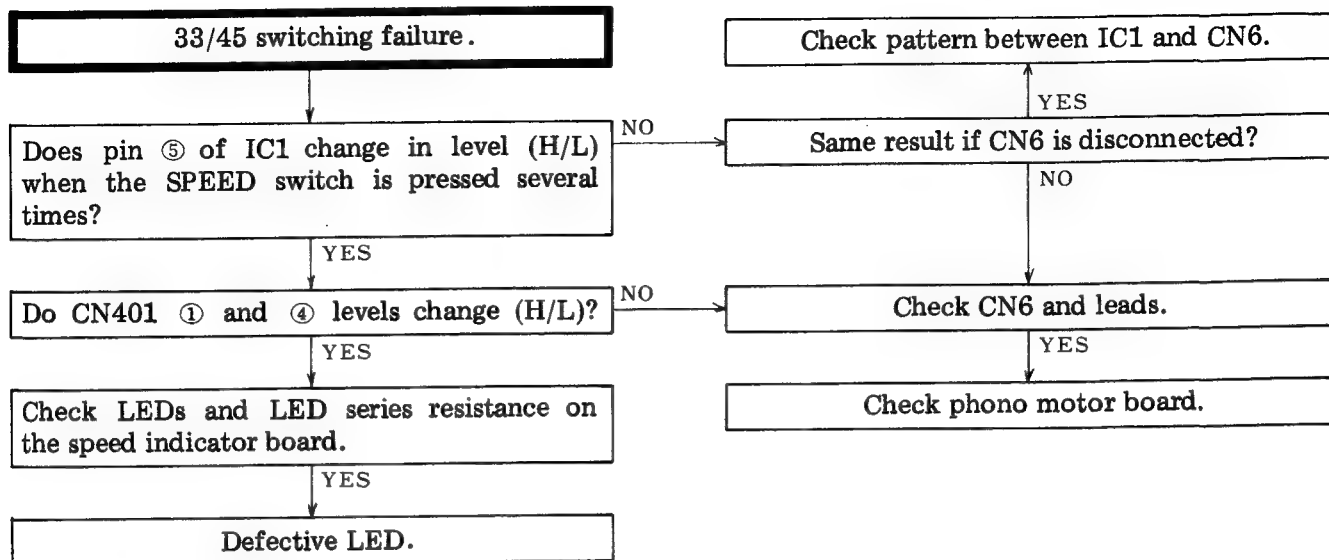
■ Switching Failure

* Check that tonearm is in arm rest.



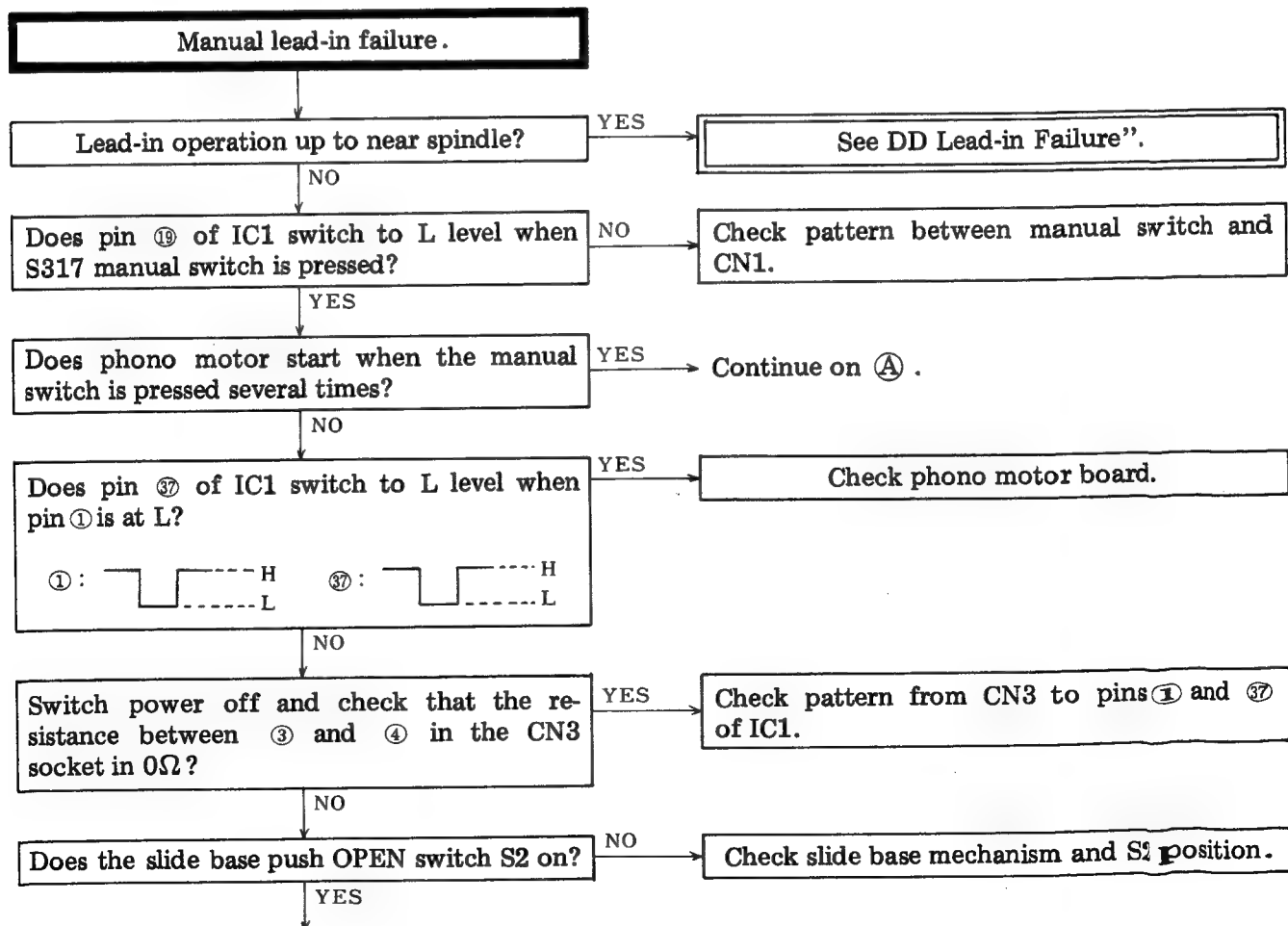
Note:
The REPEAT switch is only one example. Check the speed selector switch etc in the same way.

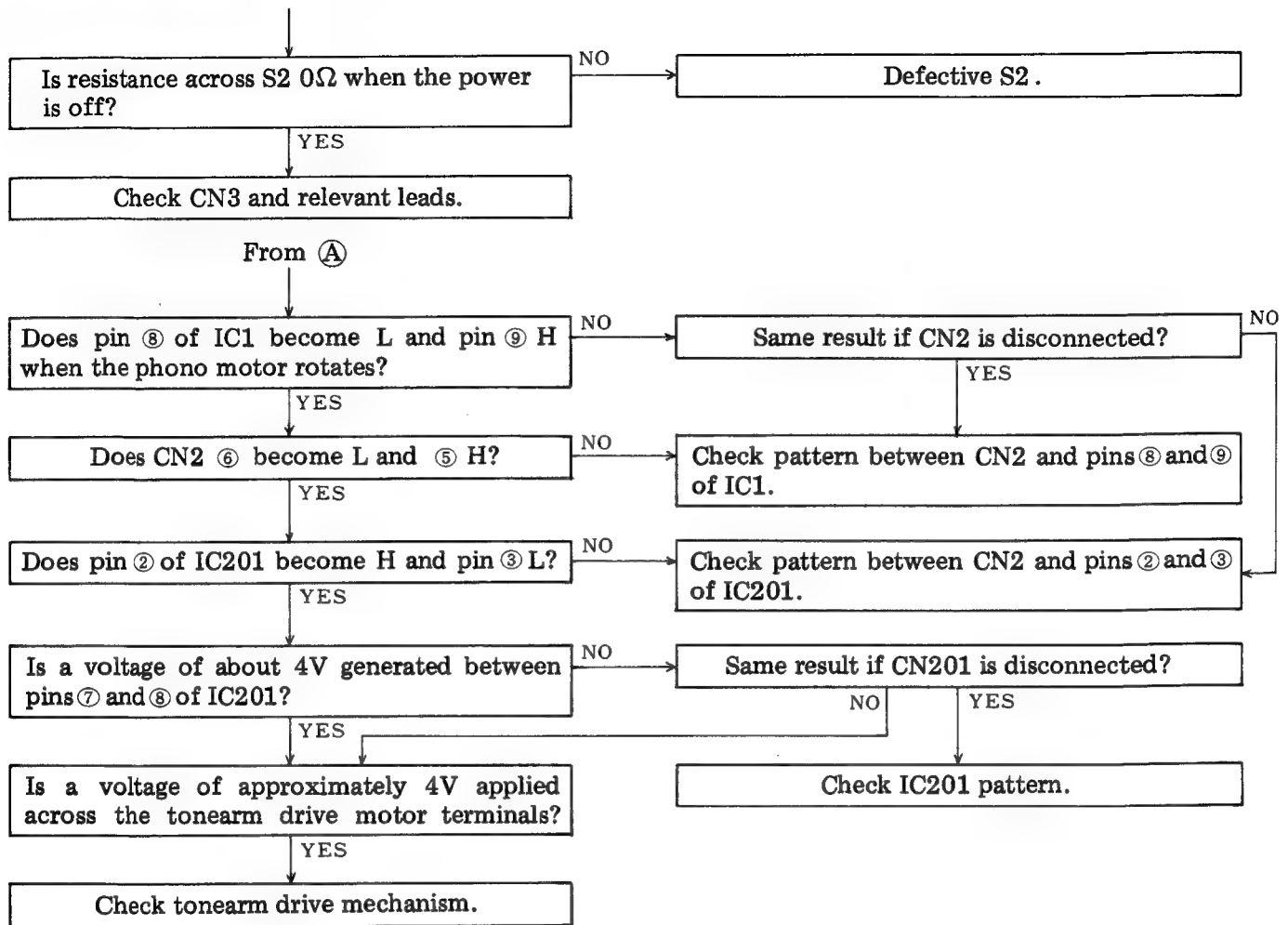
- When speed (33/45) does not change.



■ Manual Lead-in Failure

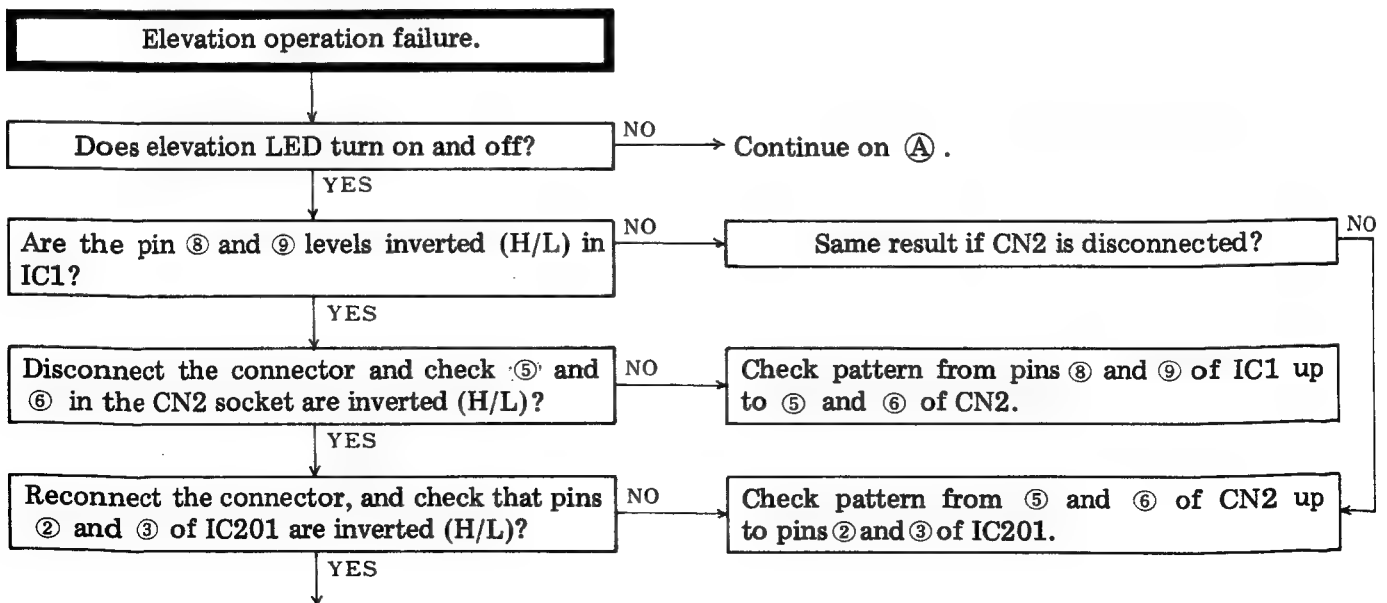
* Check after completing open operation (loading-out) and when tonearm is in arm rest.

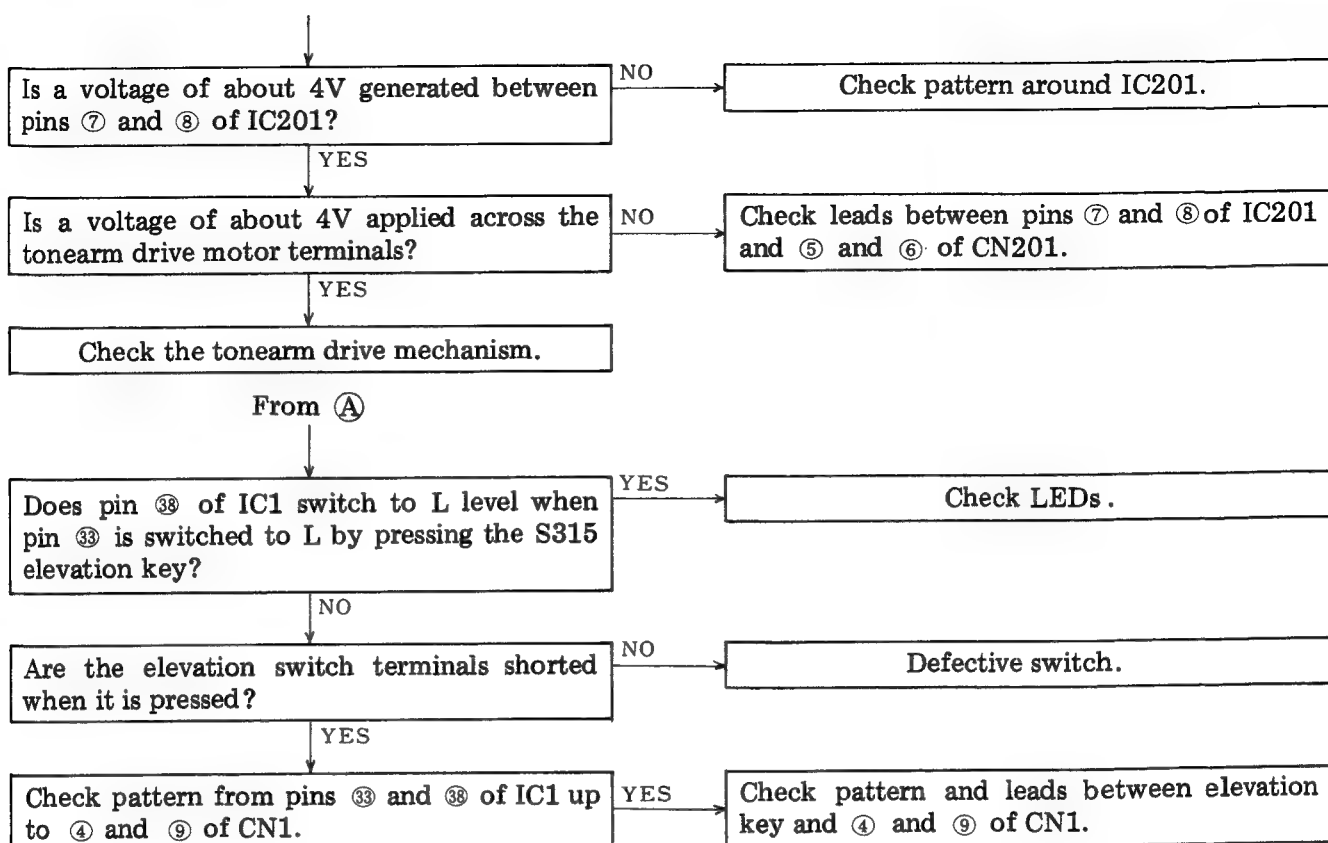




■ Elevation Arm Operation Failure

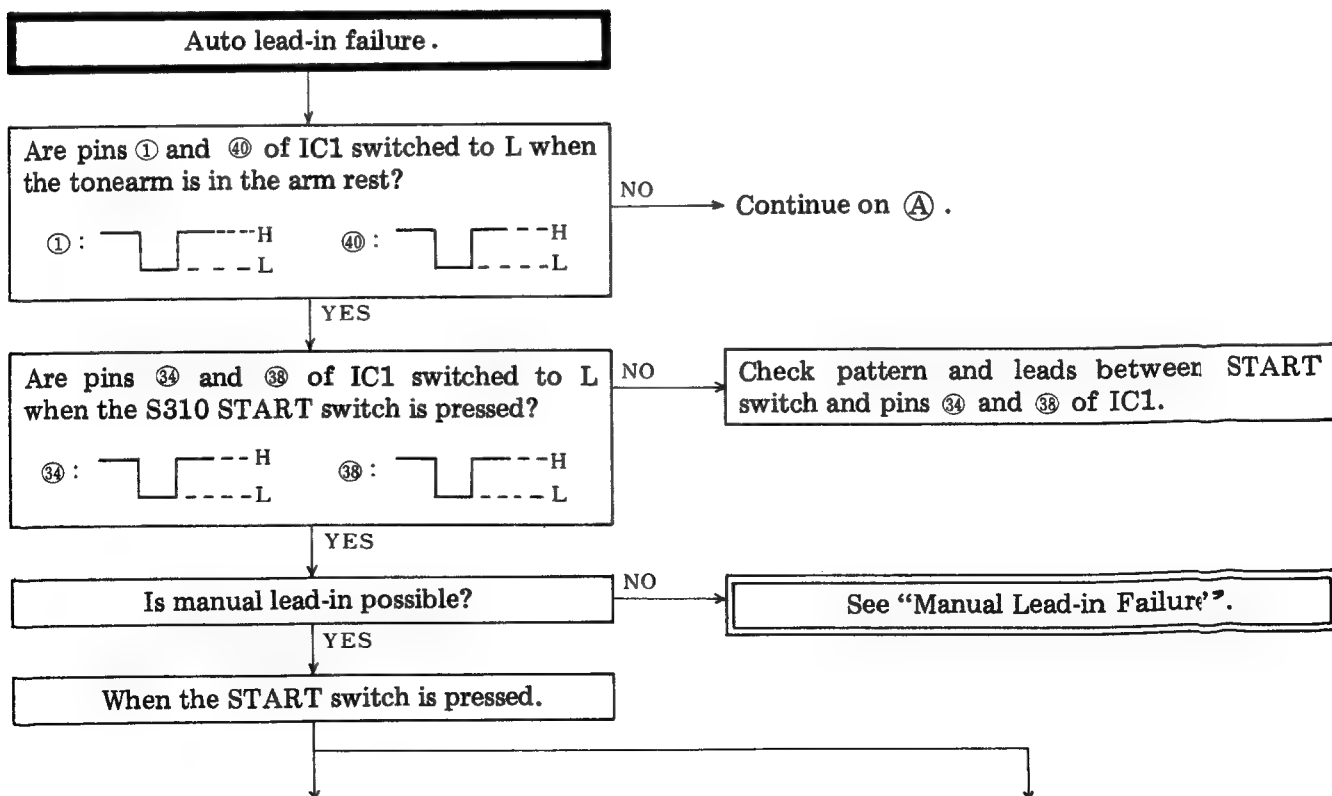
* Switch the elevation switch on and off several times in manual play mode.

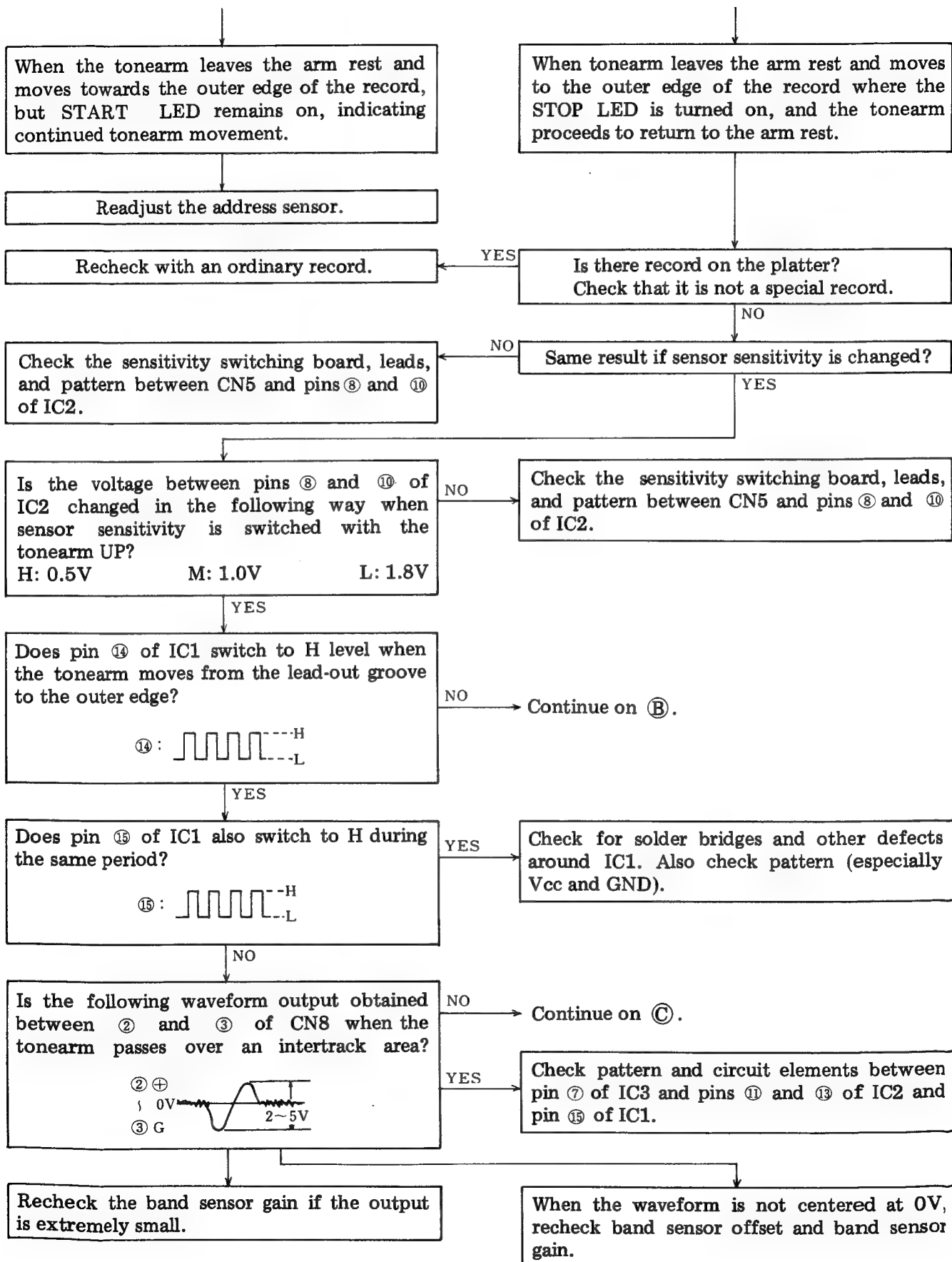


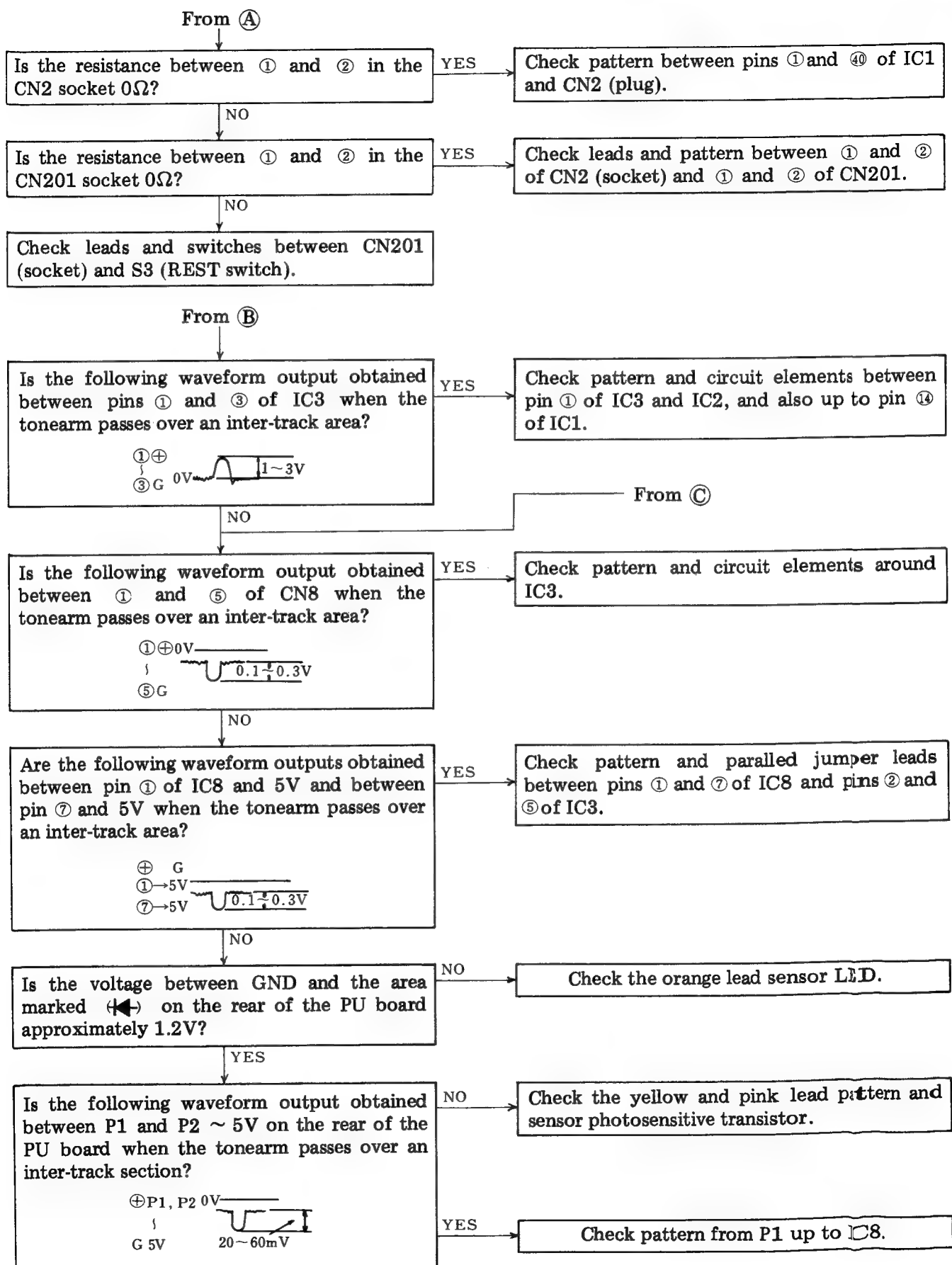


■ Auto Lead-in Failure

* Check that sensor sensitivity is normal.



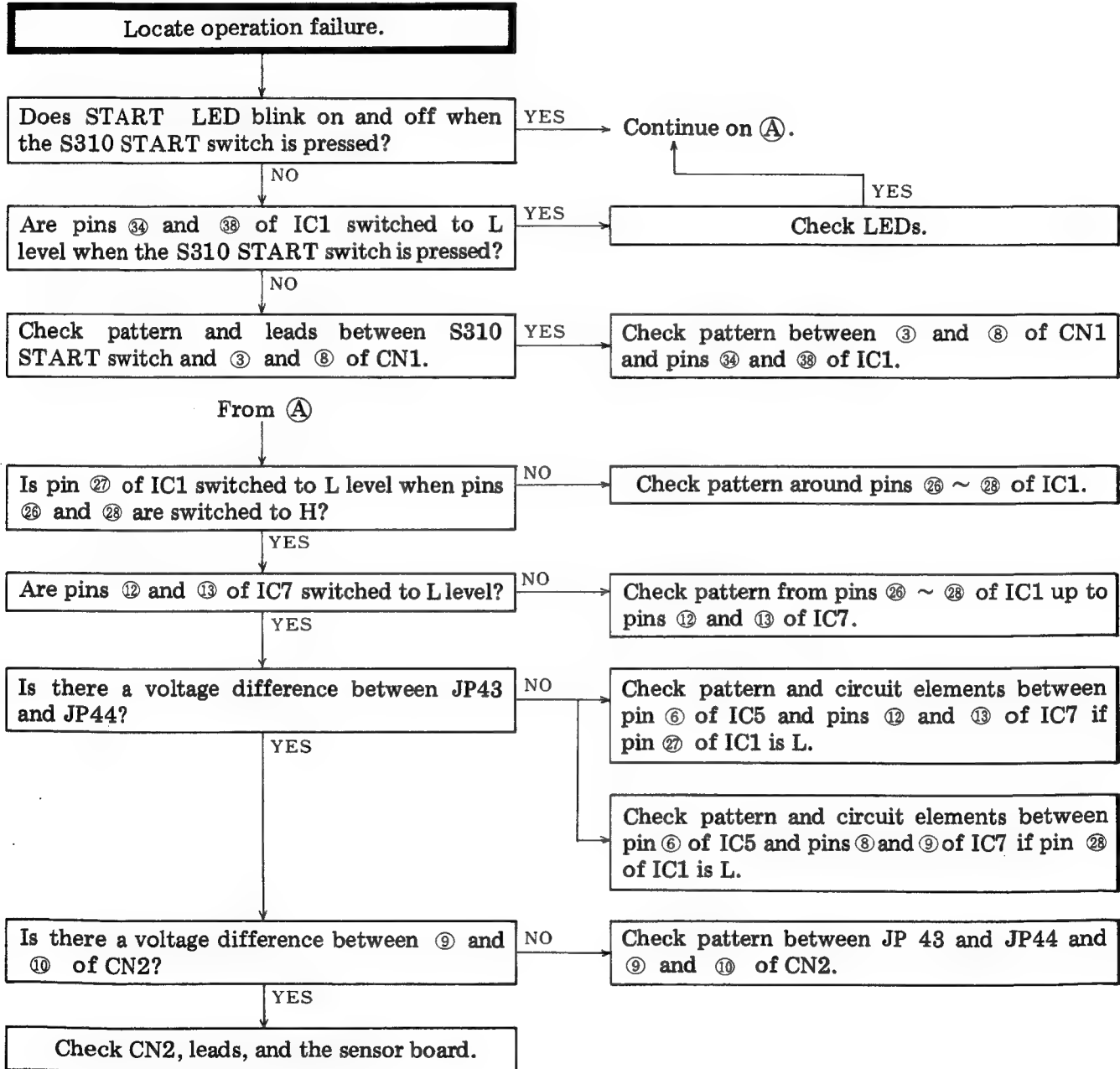




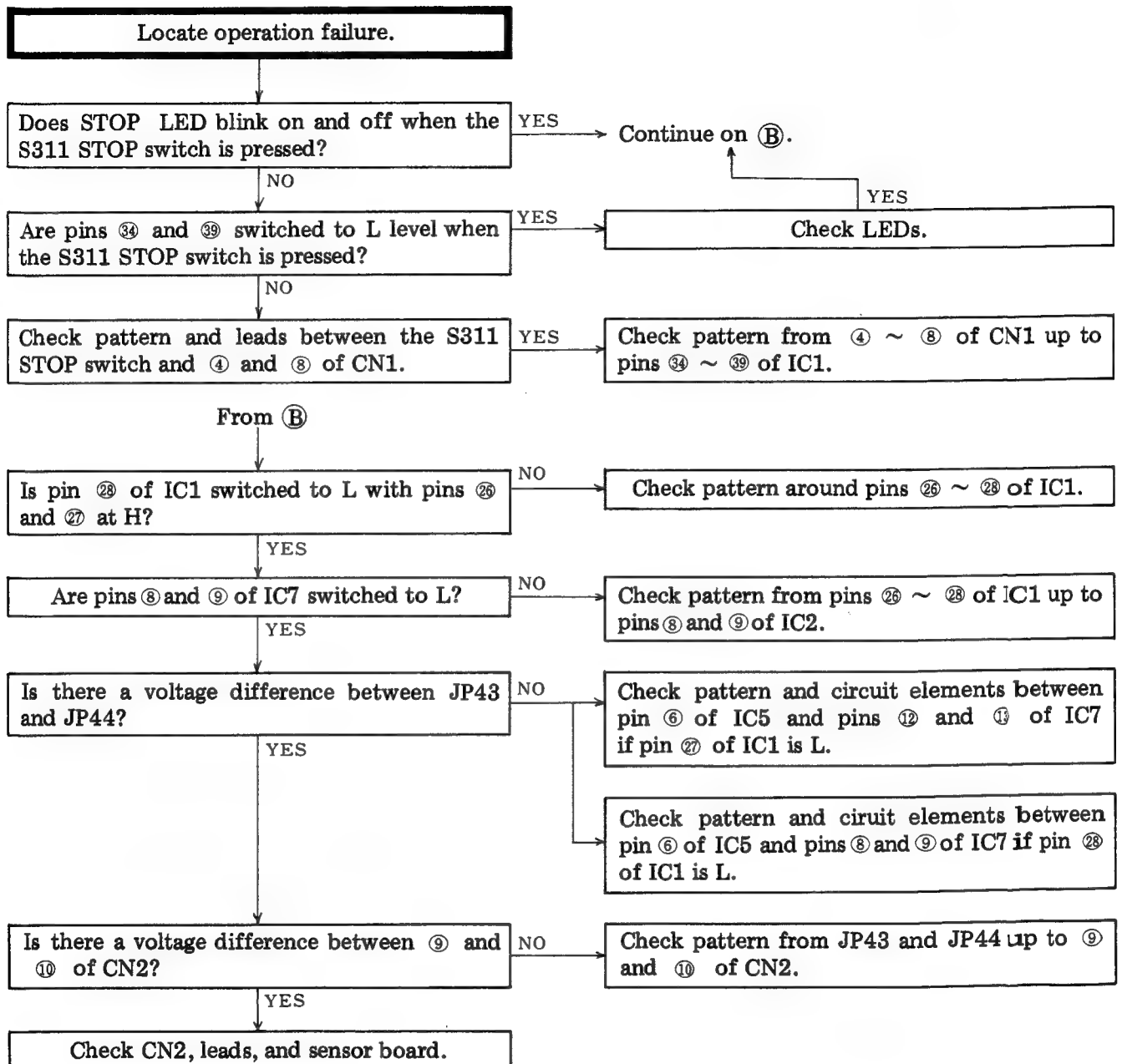
■ Locate Operation Failure

- Note:
- Check with tonearm in elevation up stop mode during manual play.
 - There are two locate operation modes-pressing of the START switch (S310) and pressing of the STOP switch (S311).

1. When START switch is pressed.



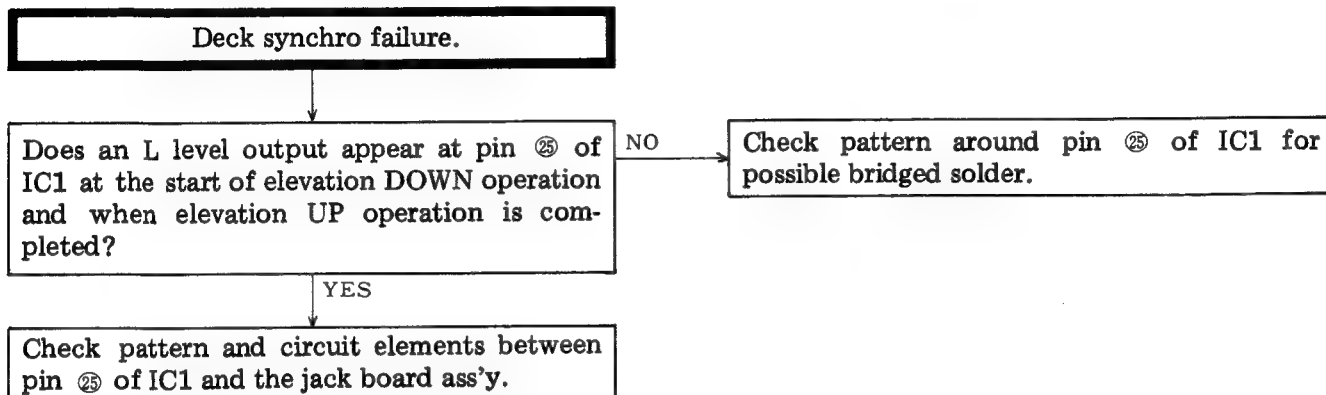
2. When STOP switch is pressed.



■ Deck Synchro Failure

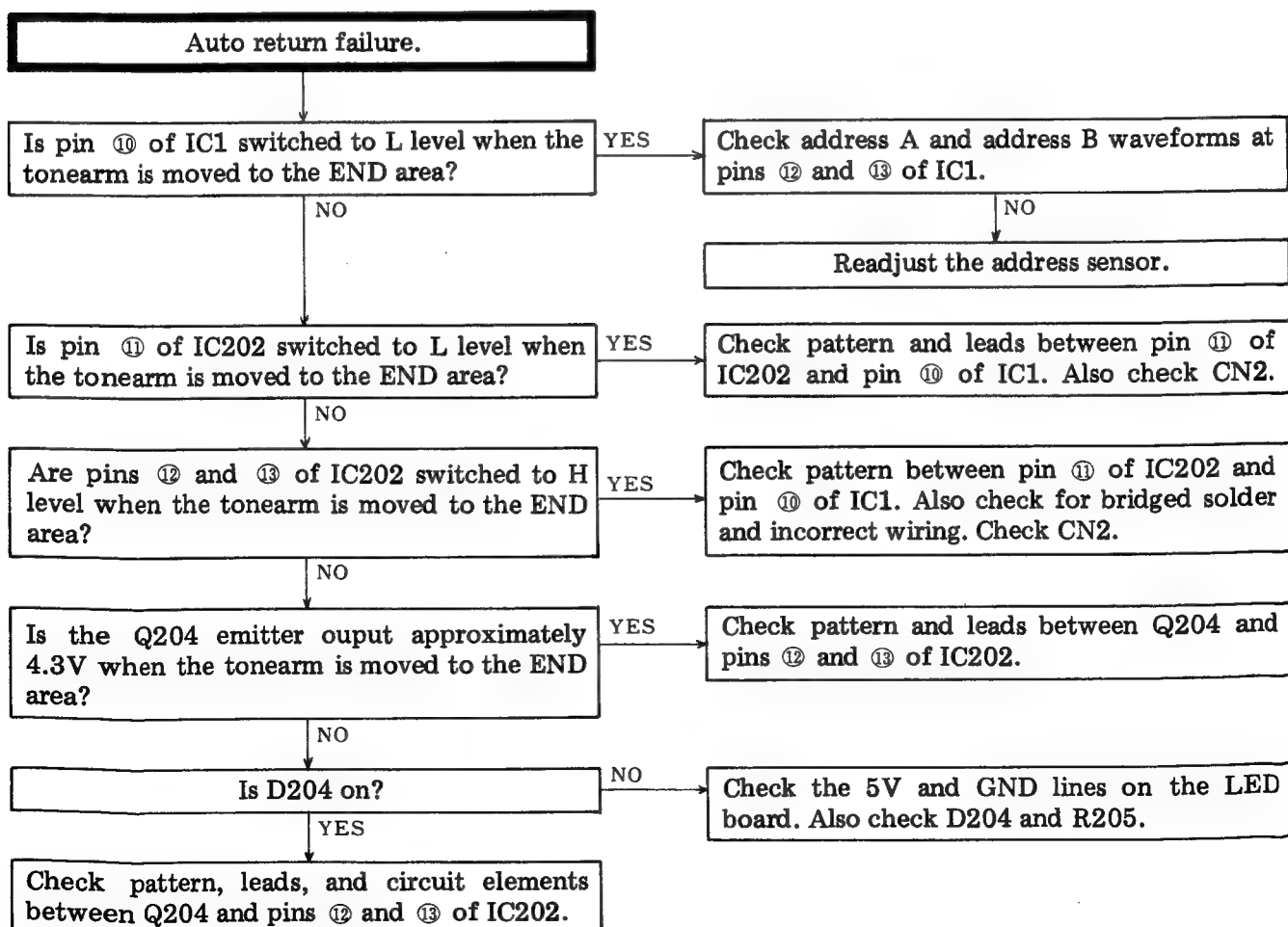
Note:

1. Connect the JC-60 cord only to the tape deck and short the "hot" side of the cord to GND to check that the deck REC PAUSE mode is switched. Switching failure in this case indicates a defective JC-60 cord.
2. Connect the turntable to the tape deck with the JC-60 cord, switch the DECK SYNCHRO switch on, and check that the UP LED is turned on. Leave the deck connected in REC PAUSE mode, and proceed with arm elevation UP/DOWN operations in manual play mode.



■ Auto Return Failure

- Auto cut operation is normal.
- Tonearm lowering position is correct.
- Check in manual play mode.



■ Inter-track Detection Failure during UP Operation

Note:

Auto lead-in operation is normal.

Check the following points in regards to the record used.

1. The width of the inter-track section must be at least 0.3mm.
2. Sound track pitch must not be too rough.
3. Record surface must be clean and undamaged.

Inter-track detection failure during UP operation.

Same result when sensor sensitivity is switched?

NO

Recheck after switching sensor sensitivity.

YES

Readjust band sensor offset and gain.

■ Inter-track Detection Failure during Play Mode

Note:

Inter-track detection operation during UP operation is normal.

Check the record for the following points.

1. The width of the inter-track section must be at least 0.3mm.
2. Sound track pitch must not be too rough.
3. Record surface must be clean and undamaged.

Inter-track detection failure during play operation.

Same result if sensor sensitivity is switched?

NO

Readjust after switching sensor sensitivity.

YES

Does the voltage between pins ⑧ and ⑩ of IC2 change as shown below when sensor sensitivity is switching during elevation DOWN operation?

NO

Check pattern around R20, and the sensitivity switching board.

H: 1.2V M: 2.3V L: 3.6V

YES

Readjust band sensor offset and gain.

■ Tonearm Drift

* Check in elevation UP stop mode during manual play.

Tonearm drift.

Has the turntable been set up on a horizontal surface?

YES

NO

Readjust the horizontal DD offset.

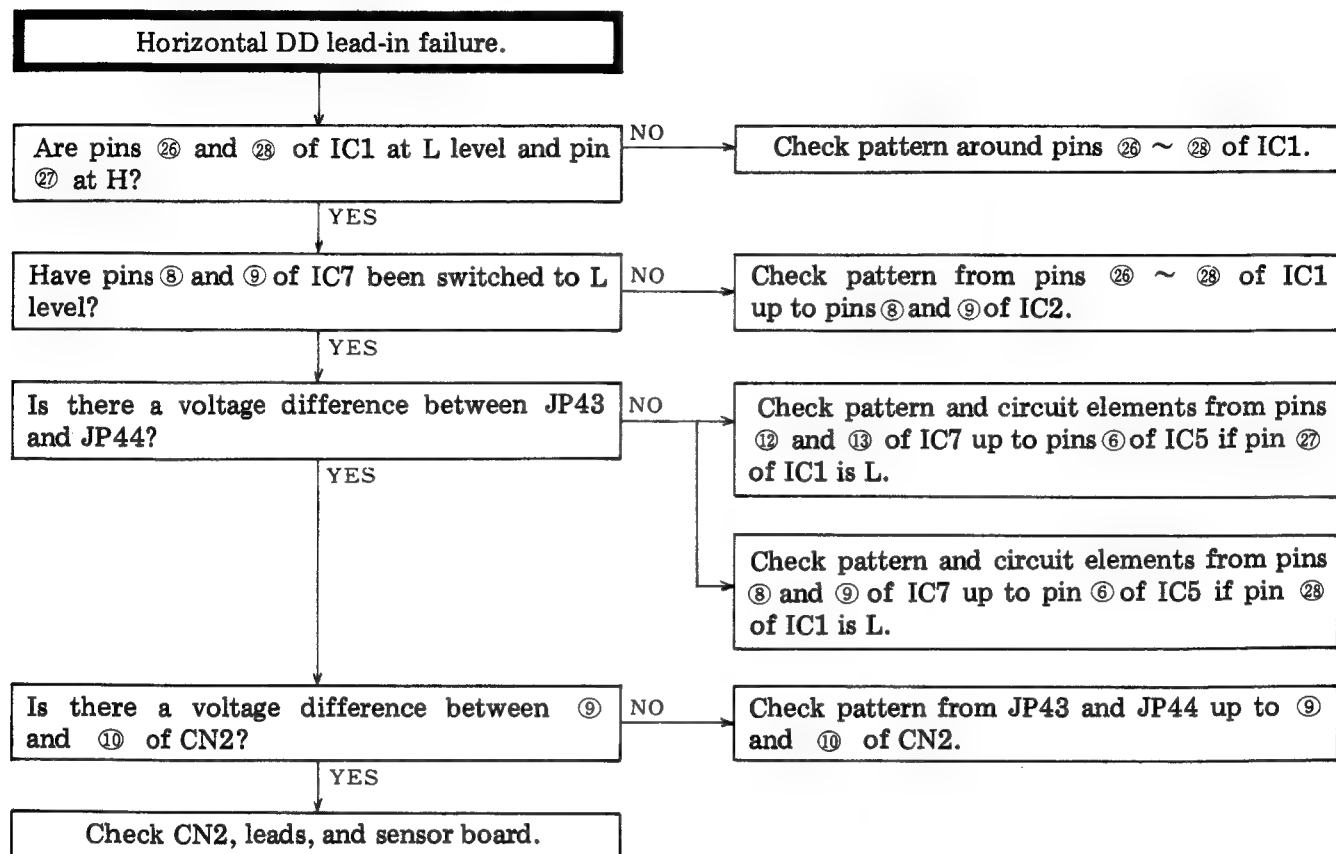
Is the voltage between JP43 and JP44 less than $\pm 50\text{mV}$?

YES

Check styling of PU leads next the tonearm.

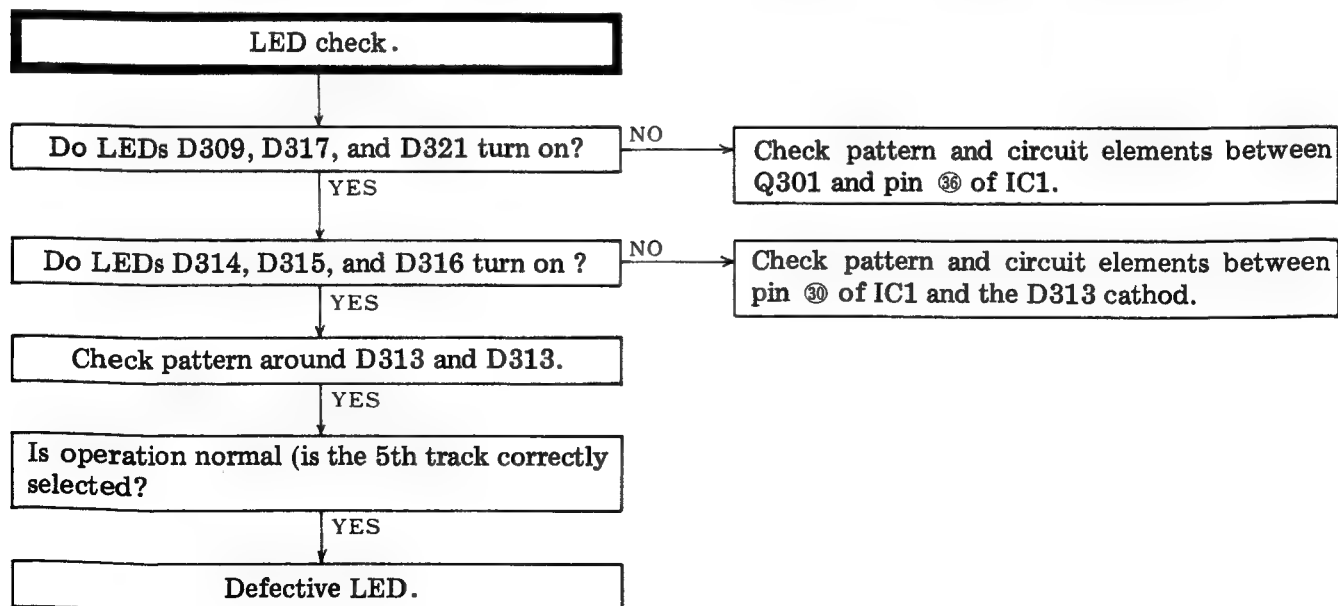
■ Horizontal DD Lead-in Failure

* Switch to manual lead-in mode, and check with the tonearm left near the center spindle.



■ LED Check

* Check procedure for dynamic switching LEDs on the operation board ass'y. In the example used here, the LED (D313) for the 5th track fails to turn on. Other LEDs can be checked in the same way.

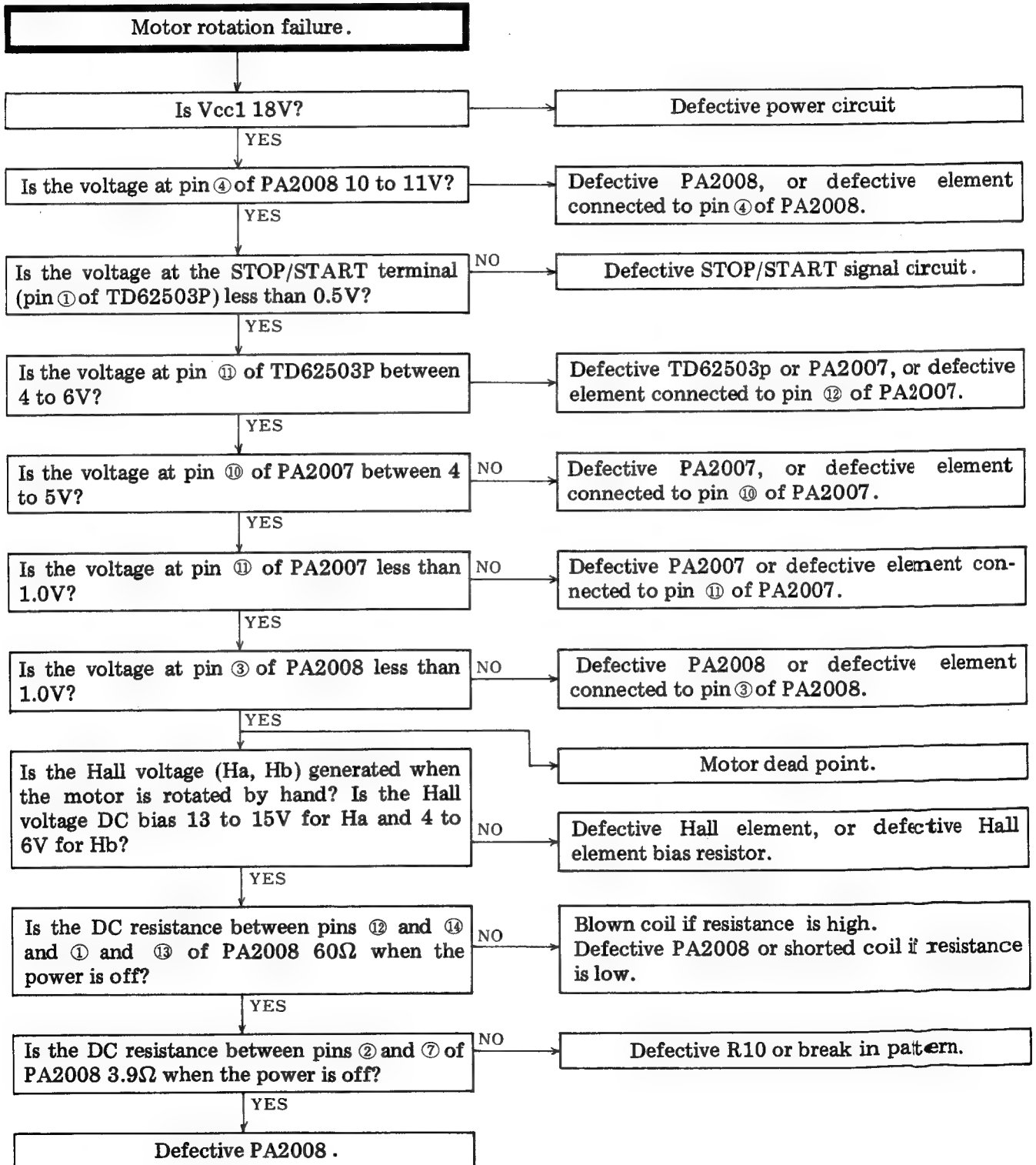


5.2 MOTOR SECTION (PL-88F)

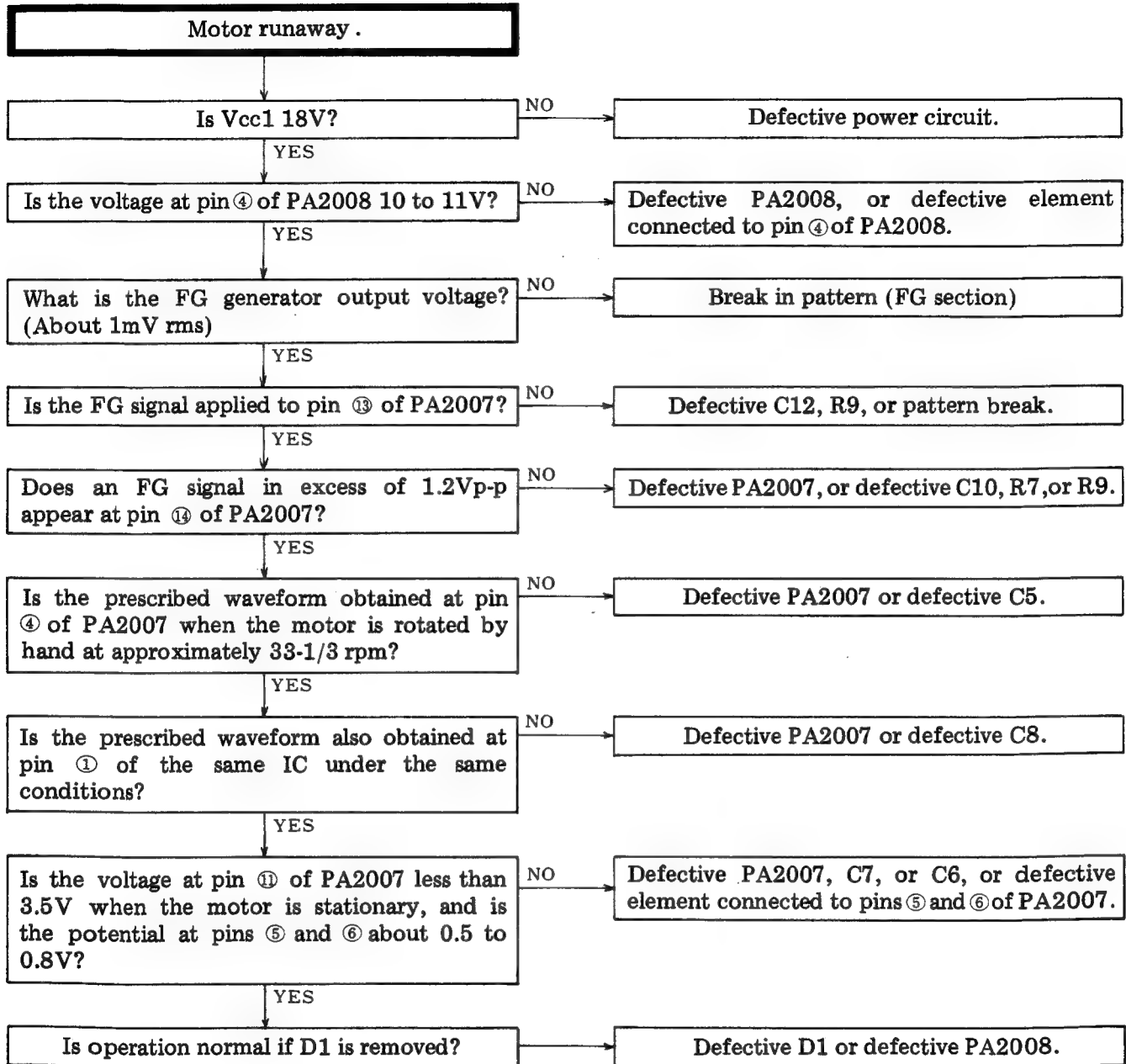
Note:

The IC PA2008 used in the motor section does not have a special pin for the internal circuit GND, but makes use of the heat sink fins instead. For this reason, when replacing ICs, make sure that the IC and heat sink, heat sink and motor base and the base and circuit board GND line are correctly connected and firmly secured by screws.

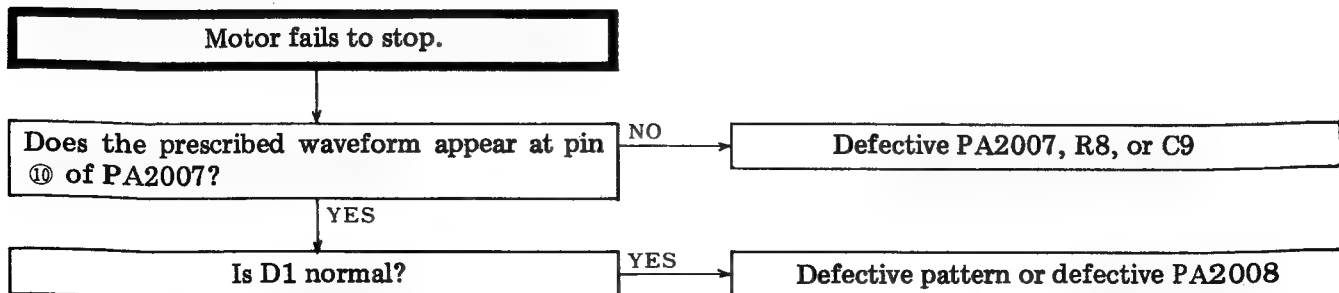
■ Motor Rotation Failure

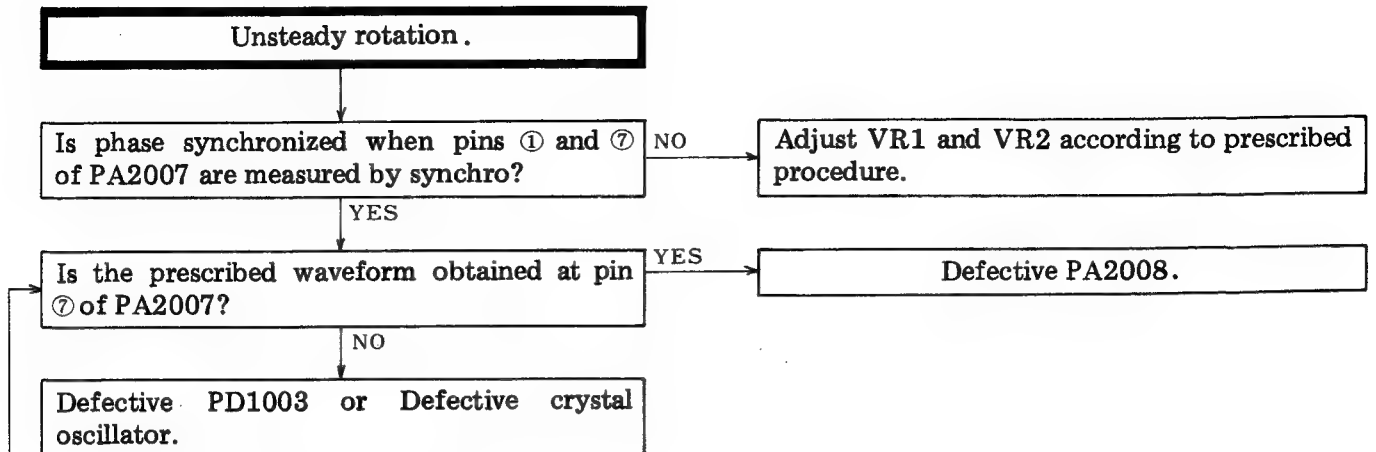
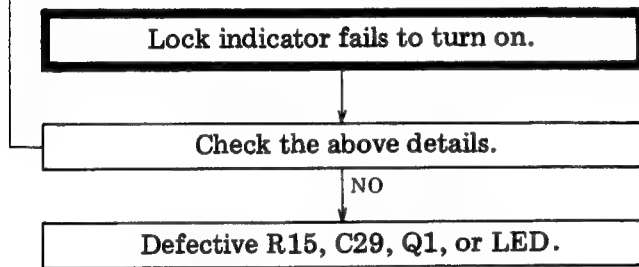


■ Motor Runaway



■ Motor Fails to Stop



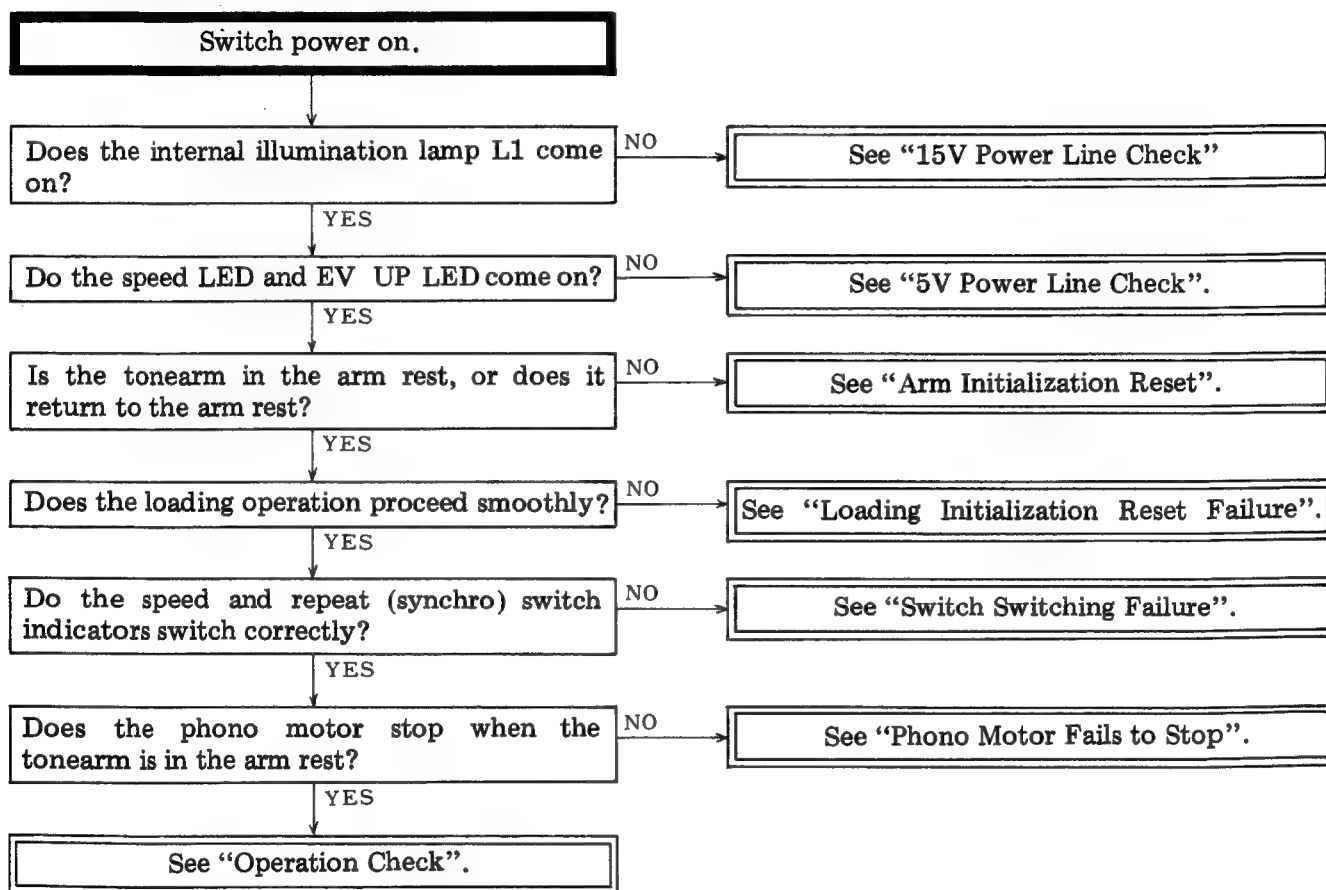
■ Unsteady Rotation**■ Lock Indicator Fails to Turn On**

5.3 PL-44F and PL-05

Note:

- Determine the location of the failure by operation check, and then refer to the relevant detailed troubleshooting chart.
- Items enclosed in are described in further detail in later check charts.
- Synchro related items refer to the PL-44F only, and are enclosed in parenthesis.
- Symbol numbers in parenthesis are PL-44F symbol numbers in places where PL-44F and PL-05 differ.

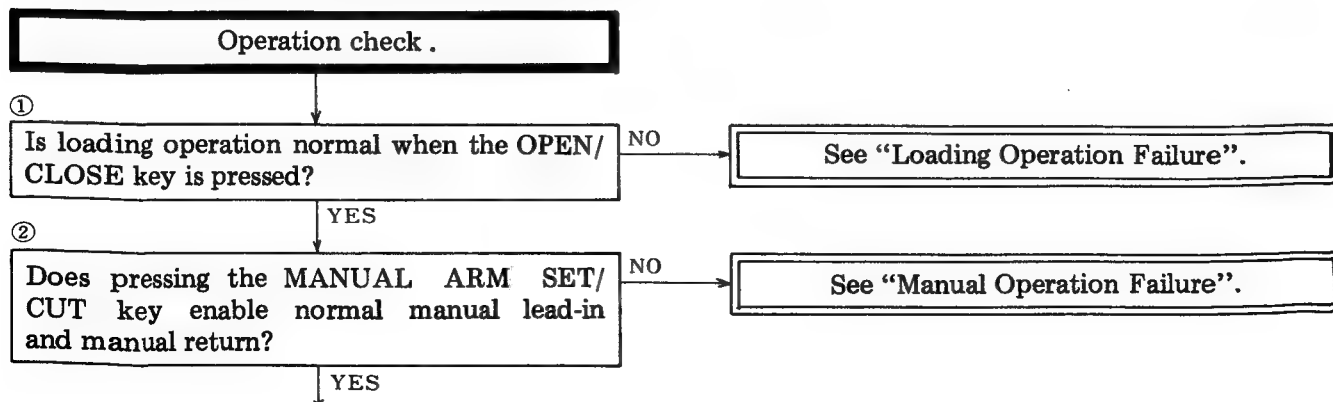
■ Locating the Cause

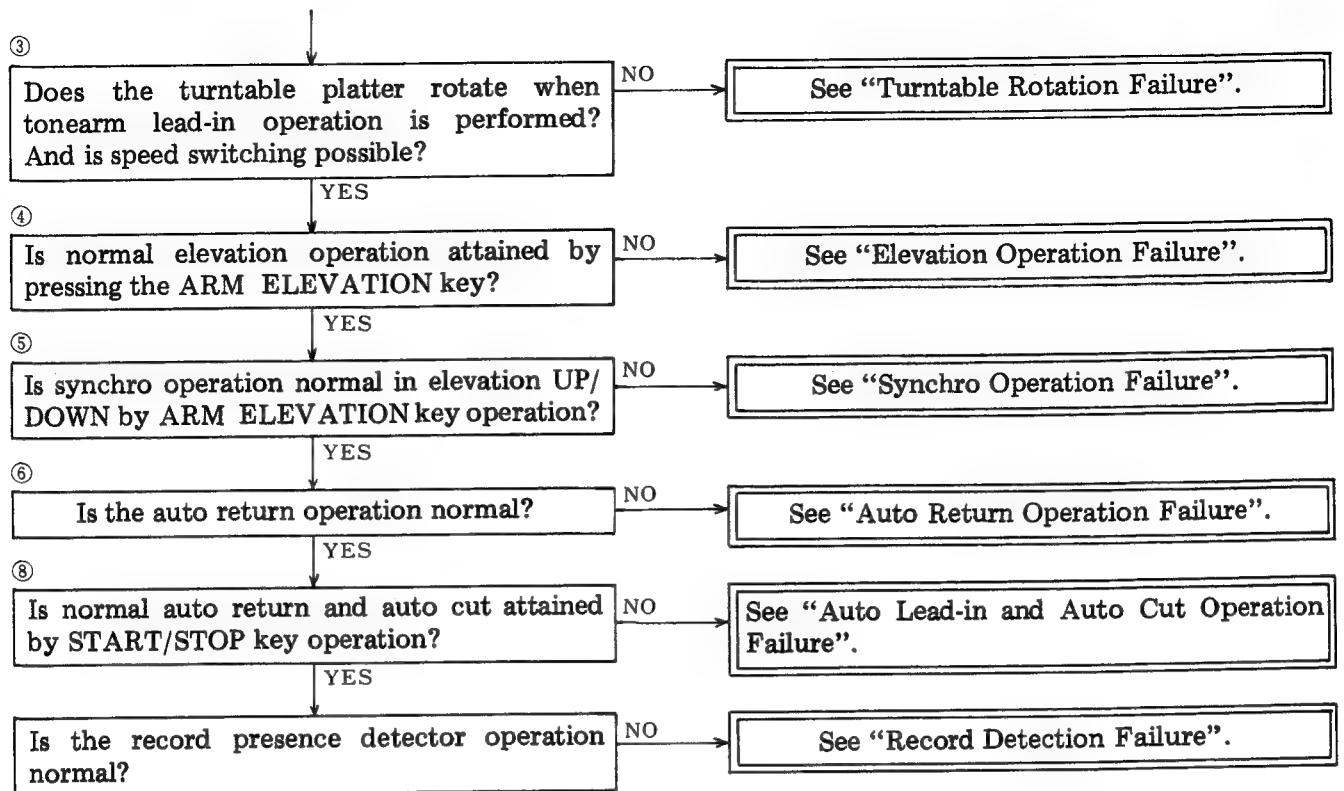


■ Operation Checks

Note:

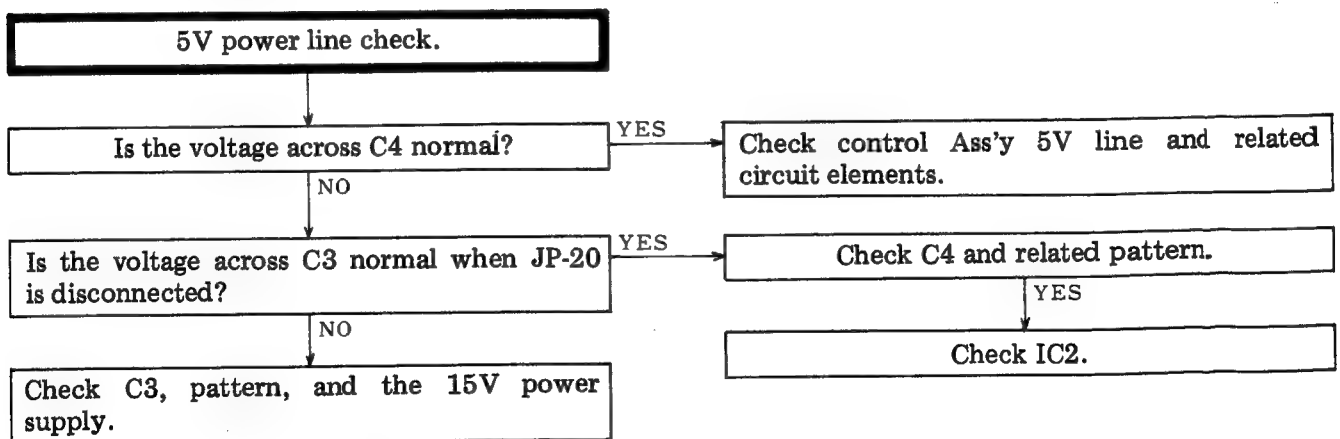
- Set the PL-44F in the following way.
Connect the turntable to the tape deck by the JC-60 cord and switch the DECK SYNCHRO switch on. Check that the UP LED is on and put the deck into REC PAUSE mode.



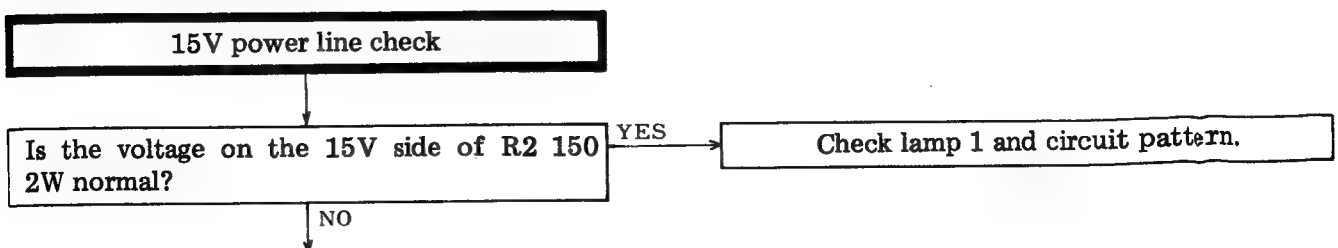


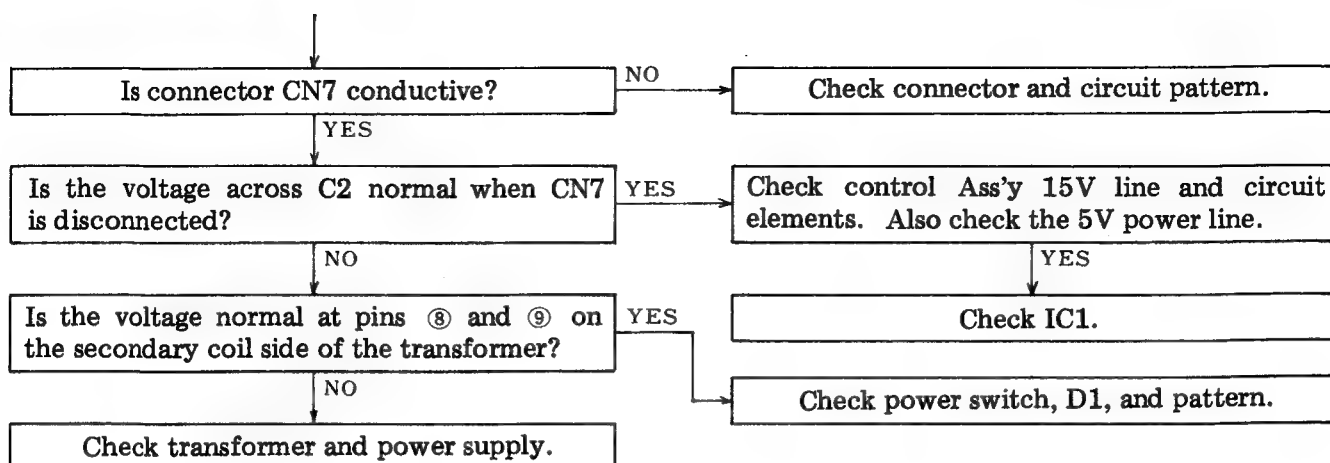
* Check items ① thru ⑥ with the slide base extended, and items ⑦ and ⑧ with it pushed back into the turntable.

■ 5V Power Line Check

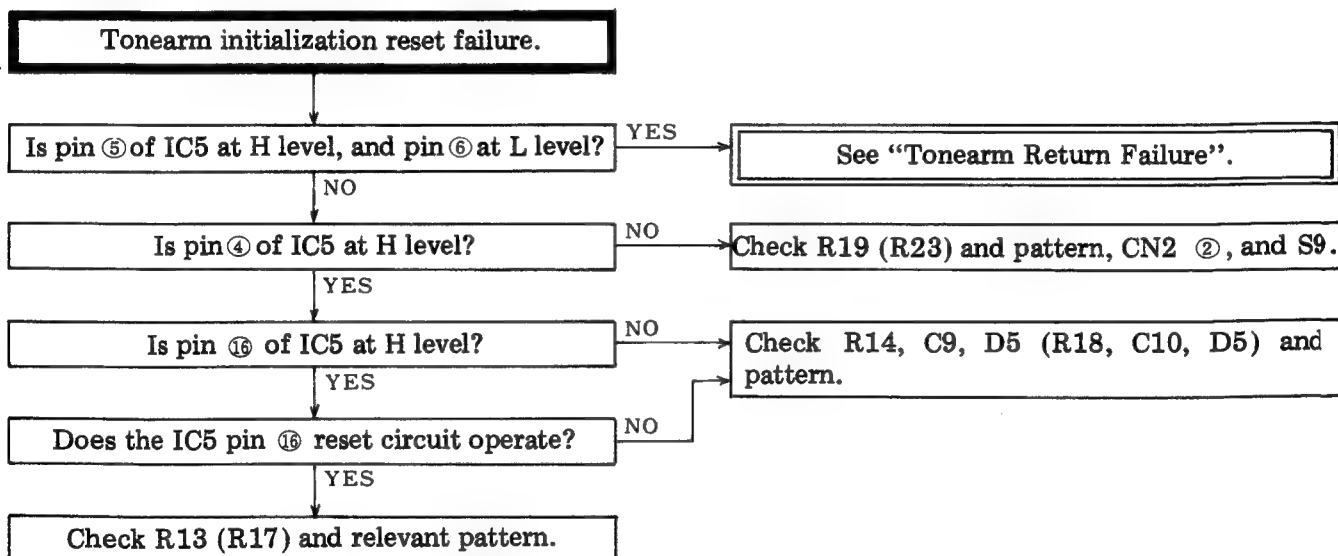


■ 15V Power Line Check

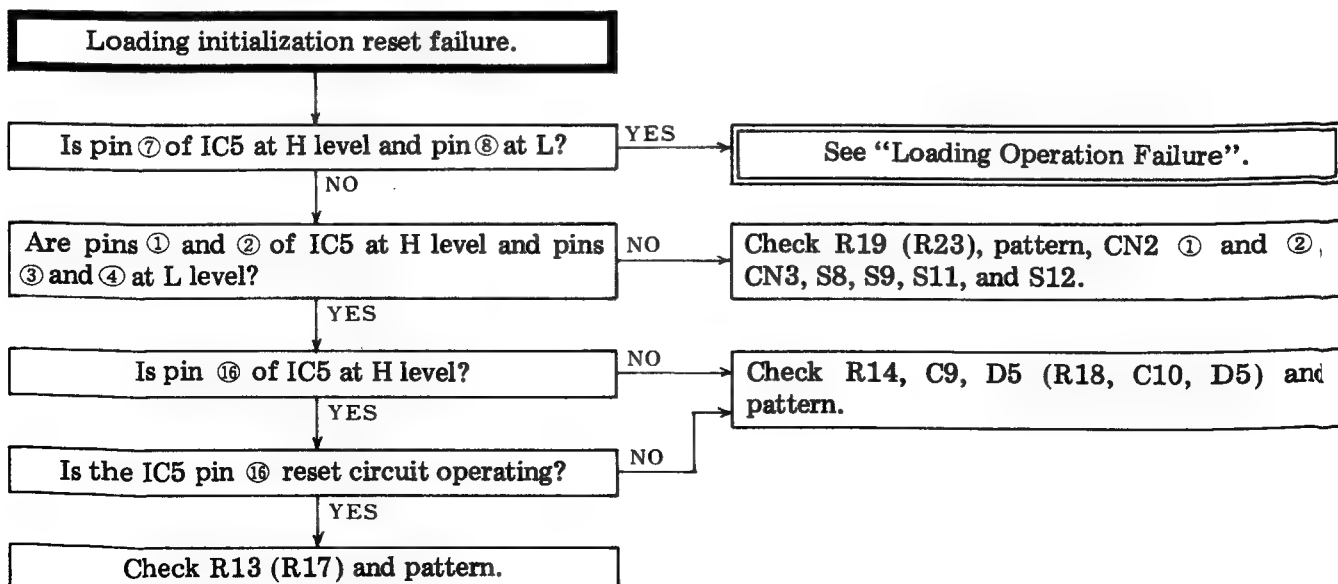




■ Tonearm Initialization Reset Failure



■ Loading Initialization Reset Failure

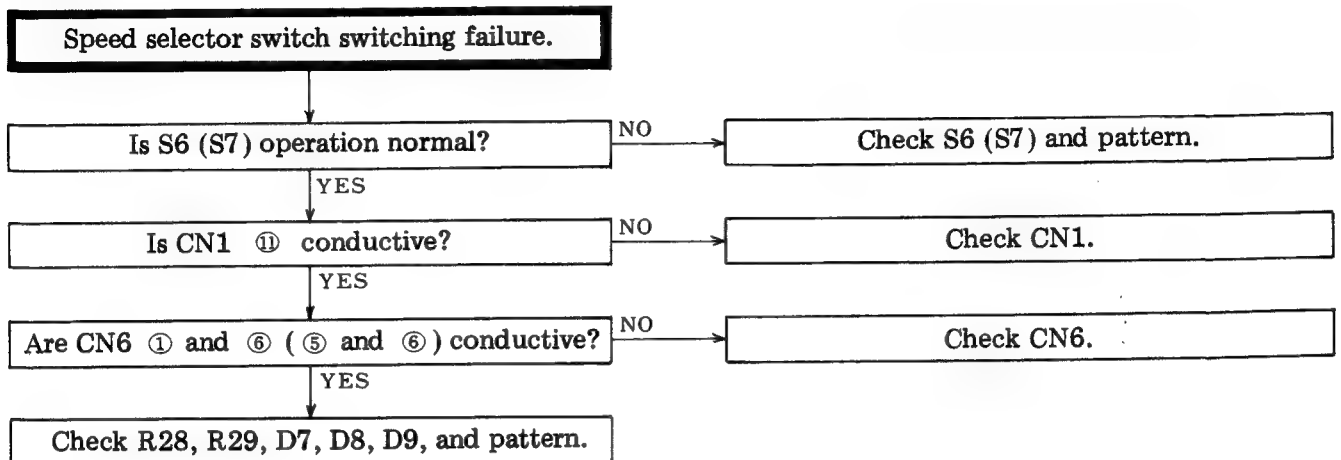


■ Switch Switching Failure

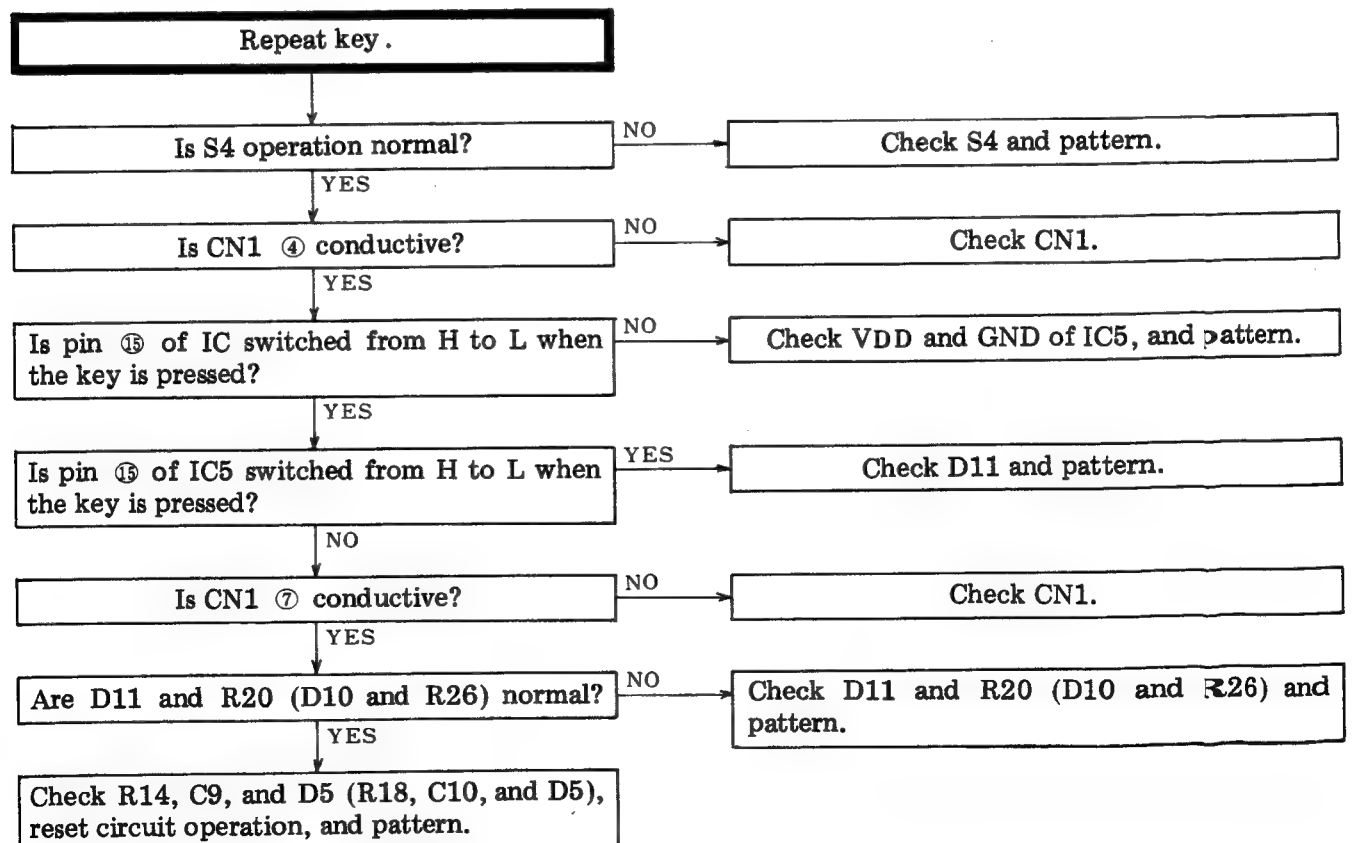
Note:

- Check with the tonearm in the arm rest, and loading operation stopped.
- Switch switching failures are divided according to type of switch and model (PL-44F and PL-05) as shown below.

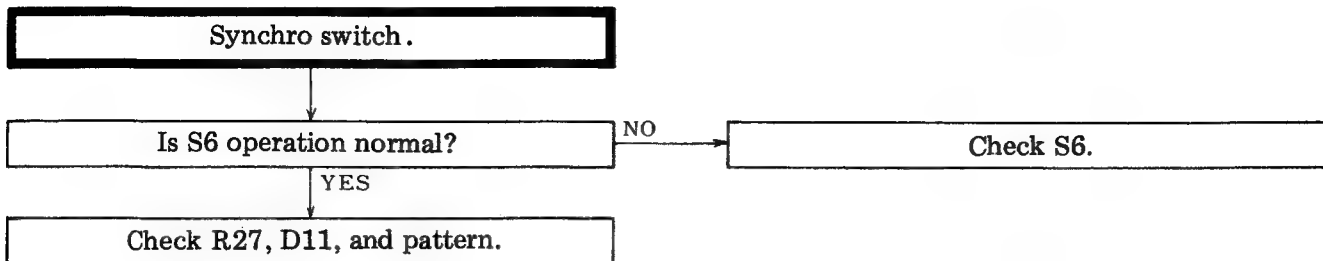
1. Speed selector switch (PL-5 and PL-44F)



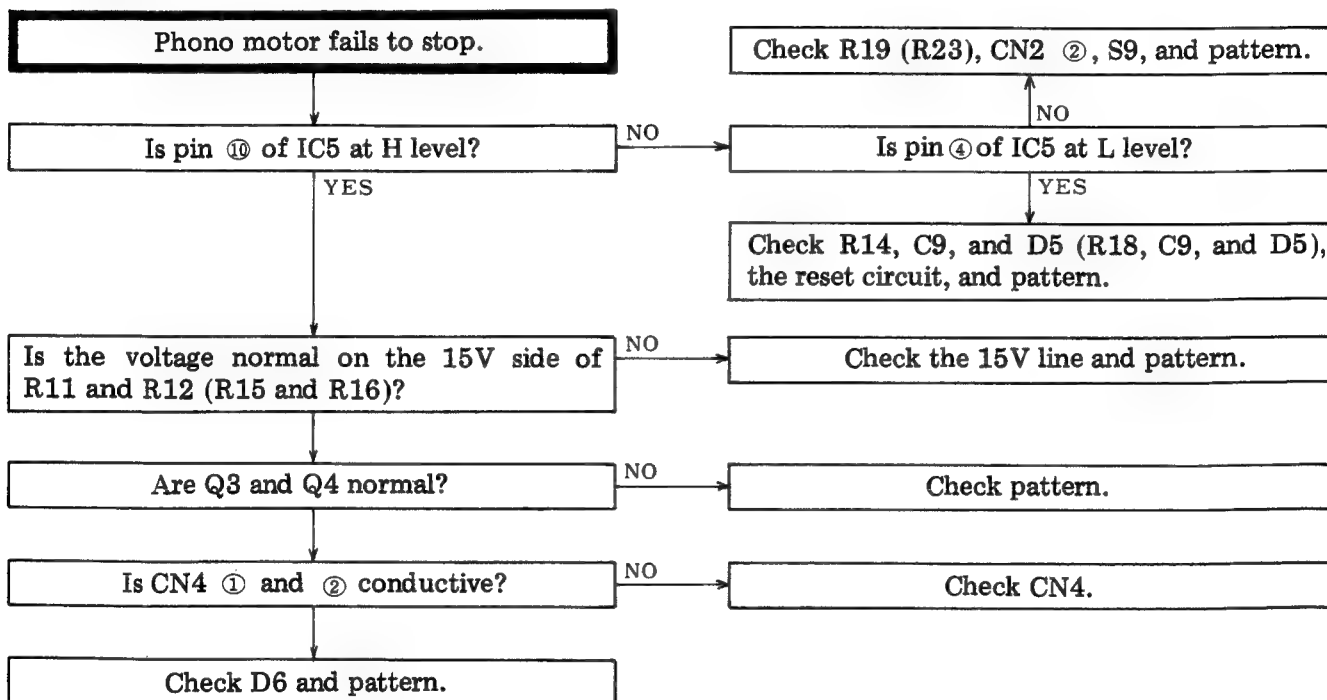
2. Repeat key (PL-05 and PL-44F).



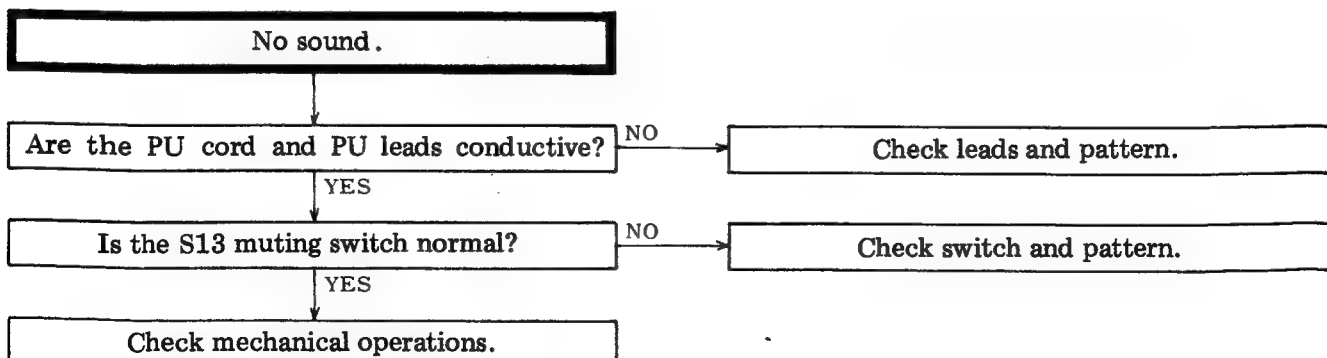
3. Synchro switch (PL-44F)



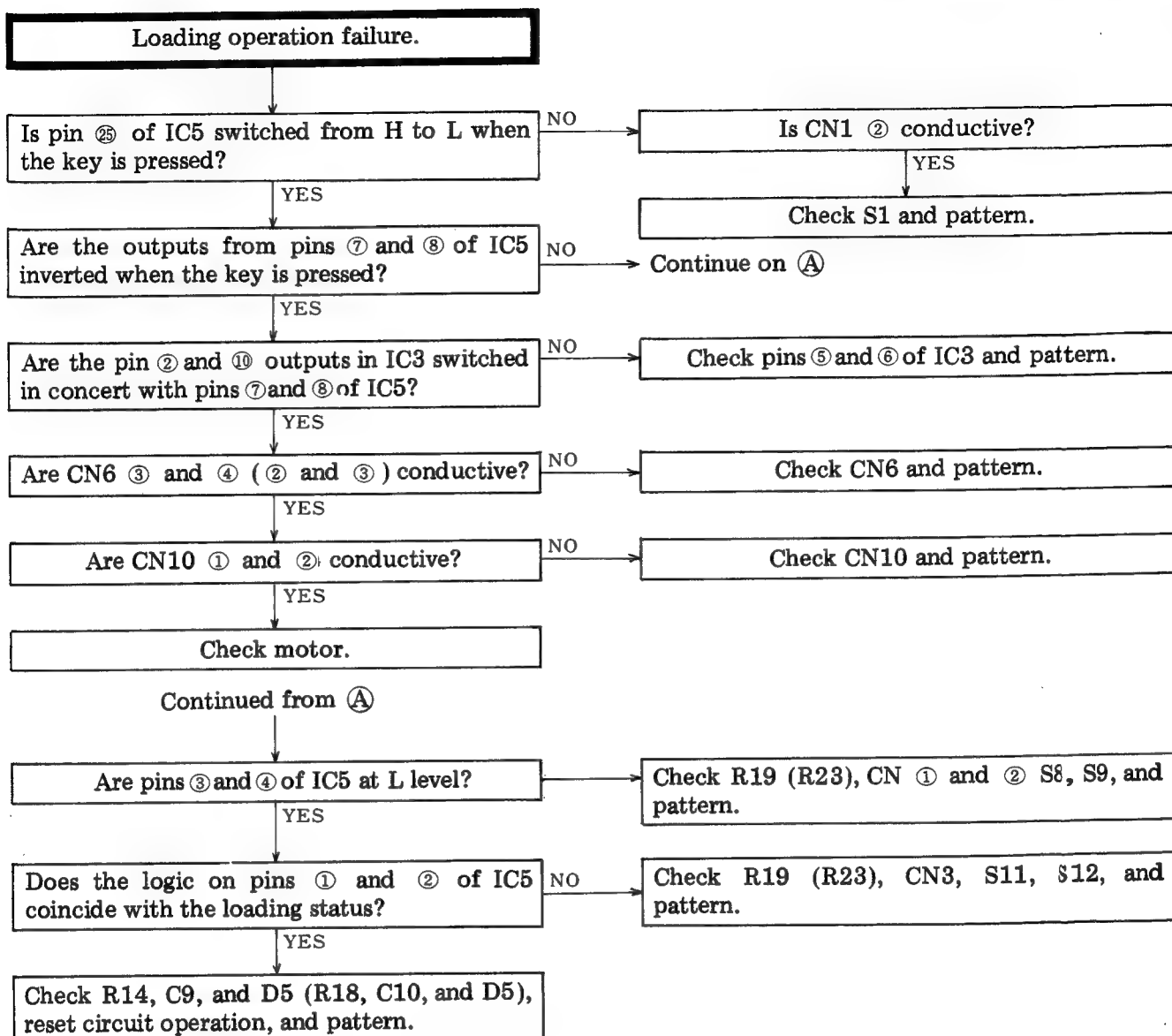
■ Phono Motor Fails to Stop



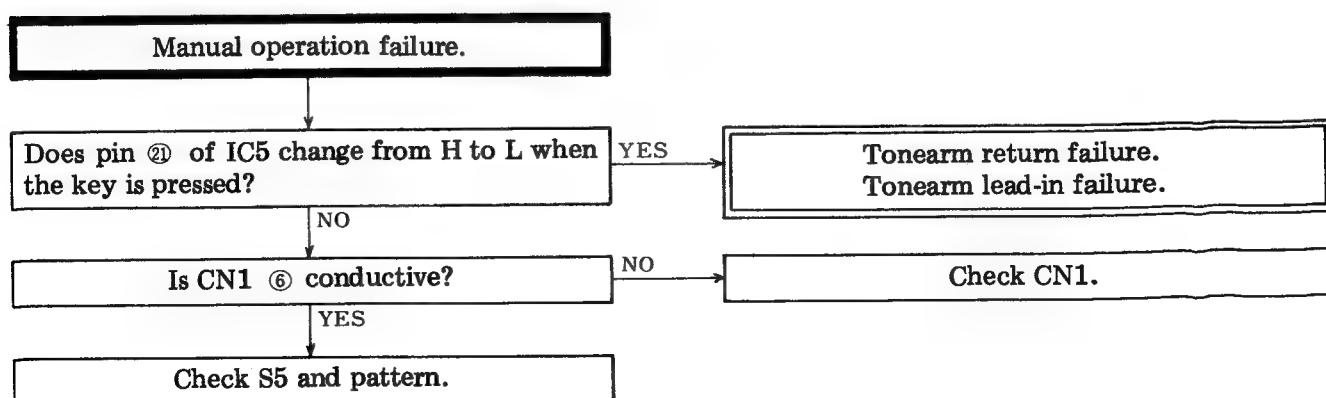
■ No Sound



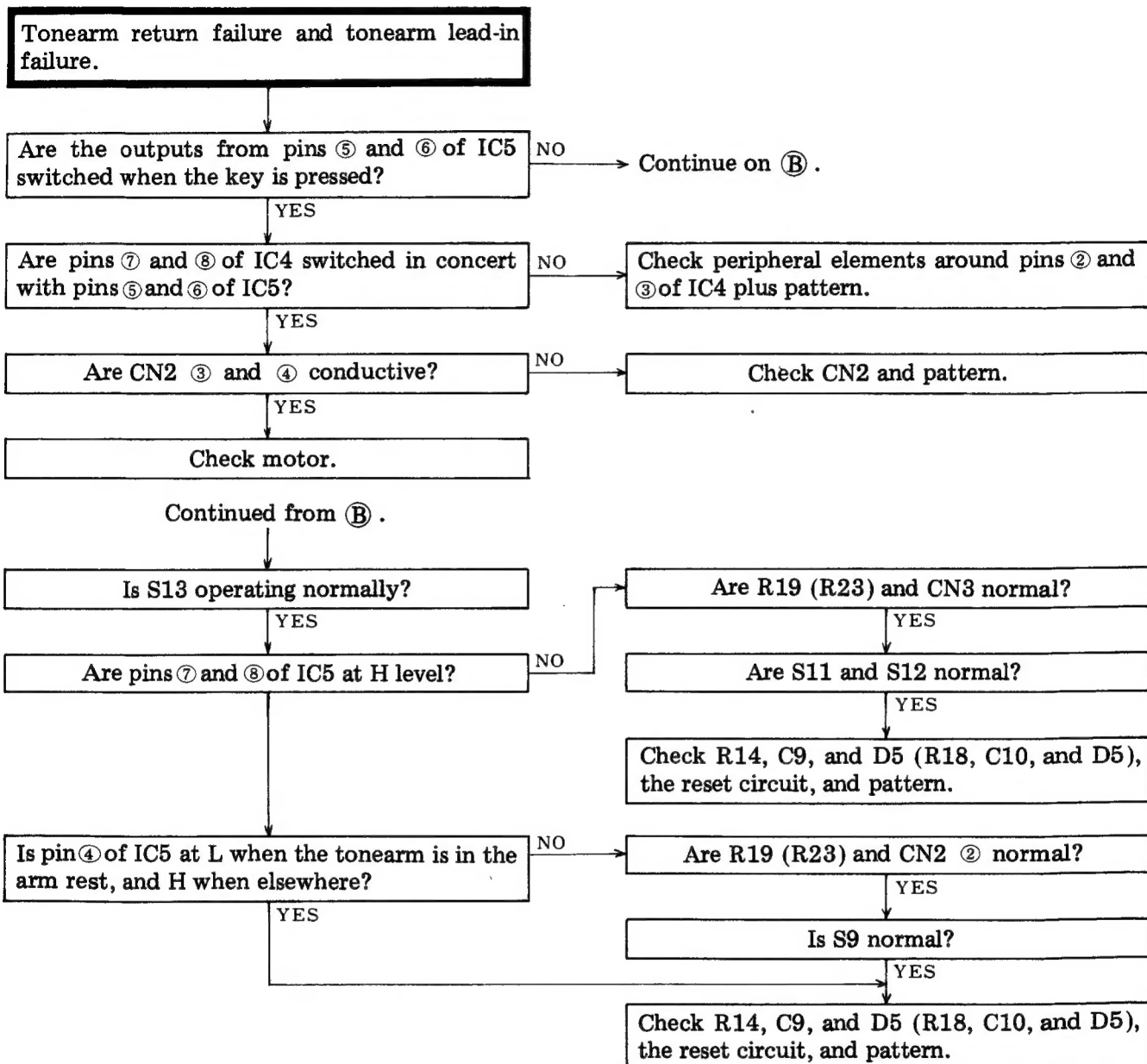
■ Loading Operation Failure



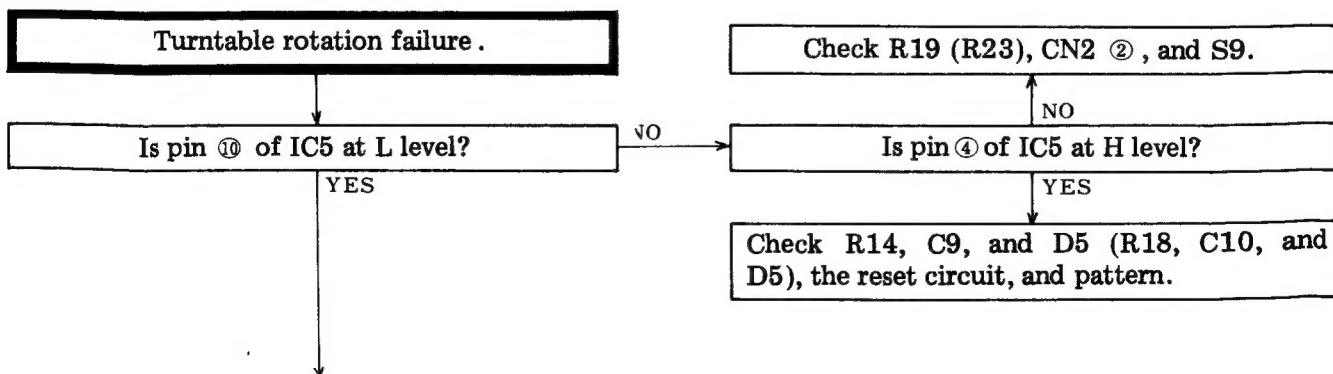
■ Manual Operation Failure

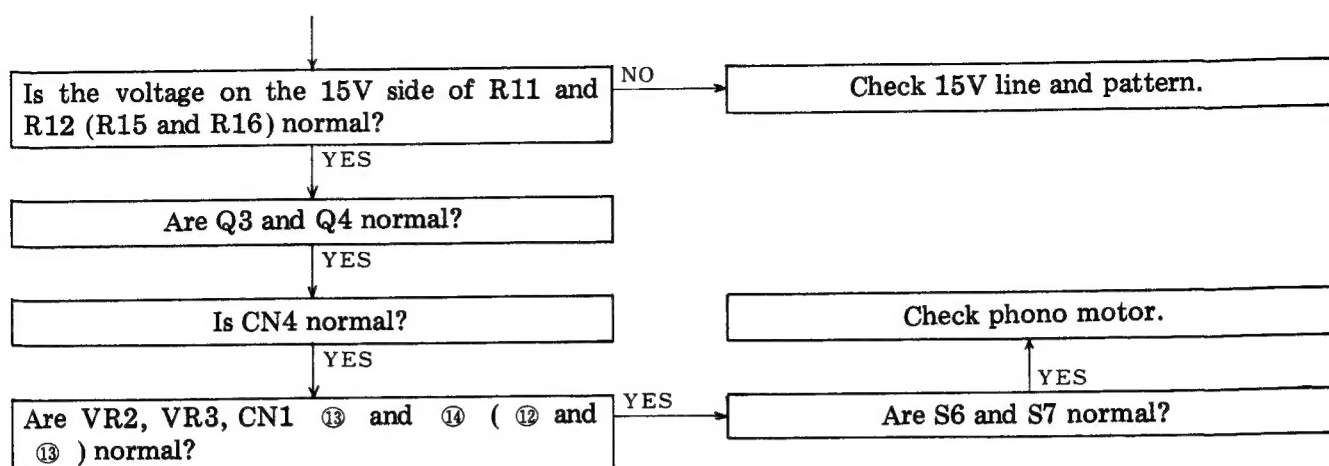


■ Tonearm Return Failure and Tonearm Lead-in Failure

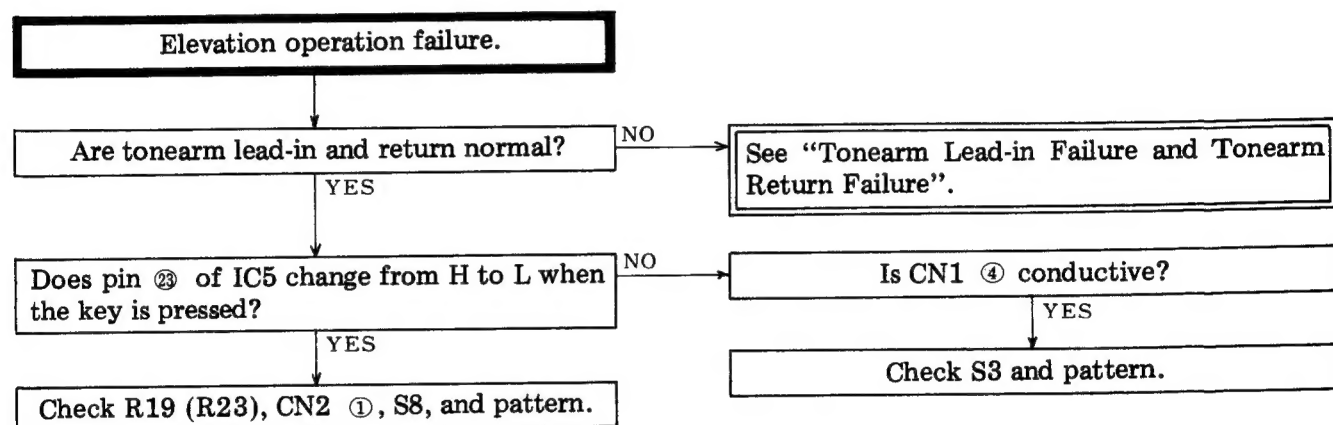


■ Turntable Rotation Failure

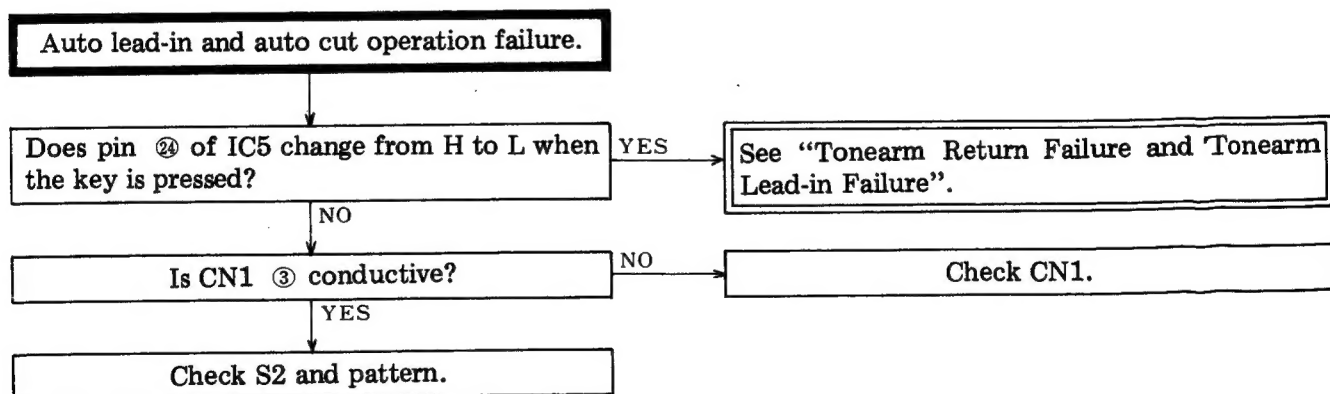




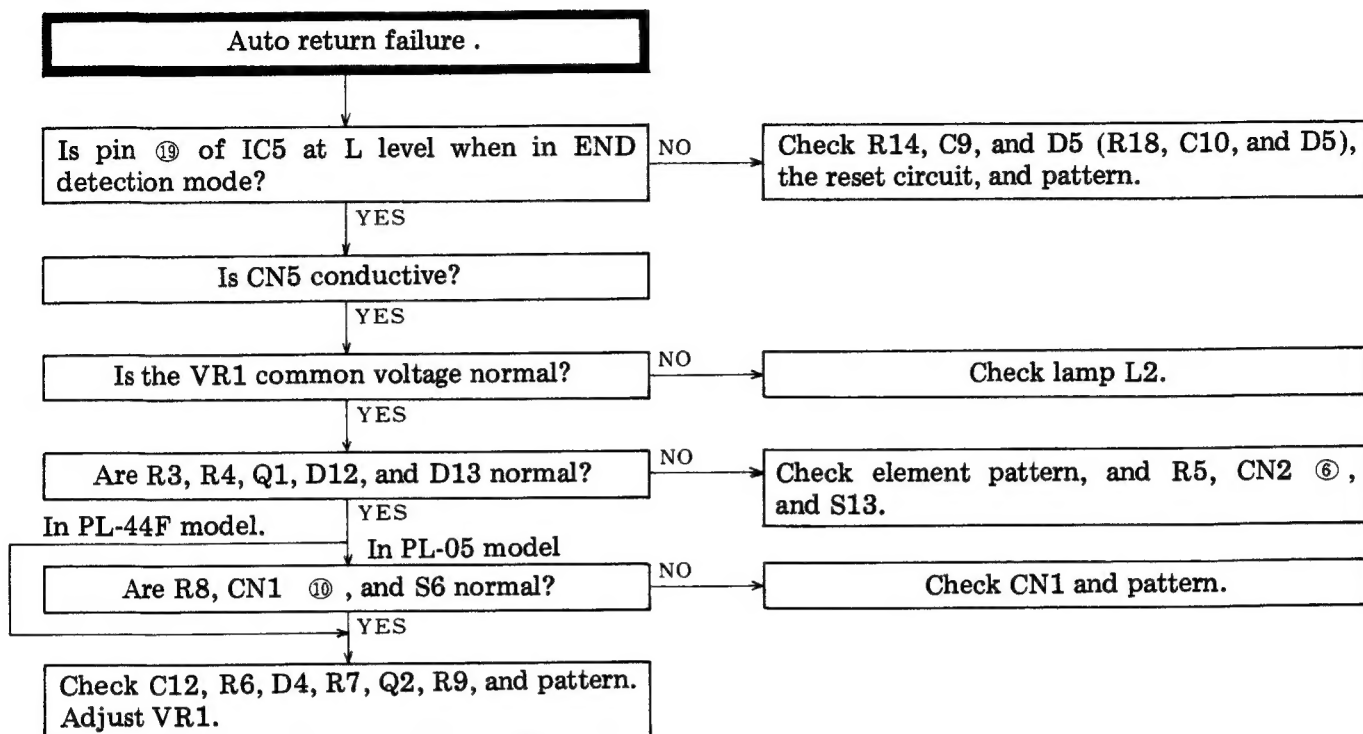
■ Elevation Operation Failure



■ Auto Lead-in Auto Cut Operation Failure

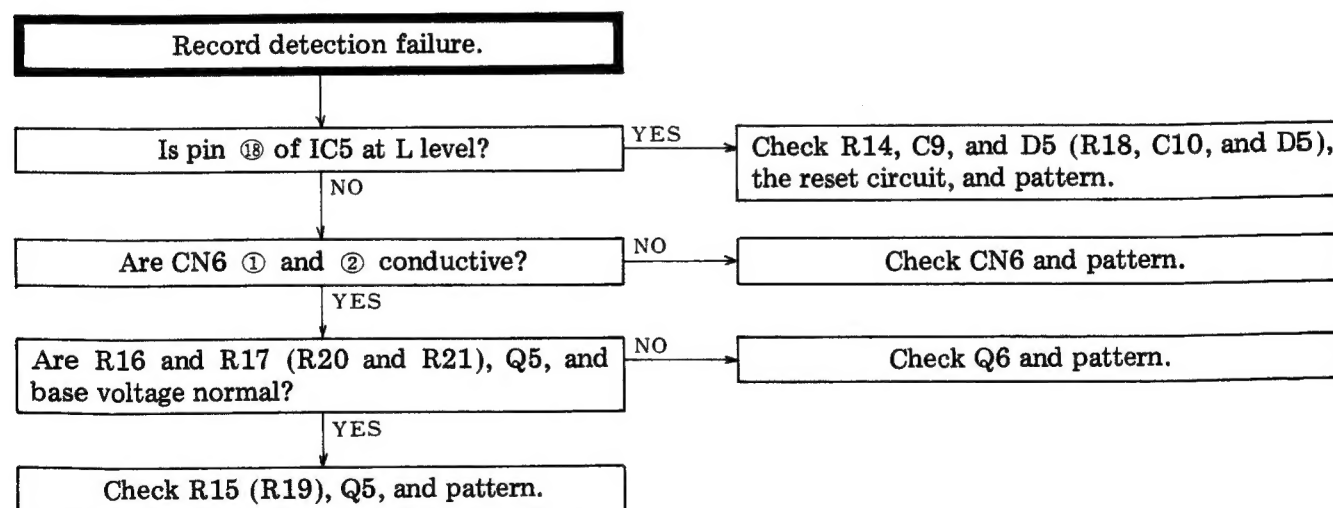


■ Auto Return Operation Failure



■ Record Detection Failure

* Set the turntable platter and rubber mat to ensure that light from lamp L1 is beamed onto photo-sensitive transistor Q6.



■ Synchro Operation Failure

* For PL-44F model only.

